

# HP Basic Instruments Catalog

Your budget's limited.  
Your equipment doesn't  
have to be.

**H P D I R E C T**



995-1996

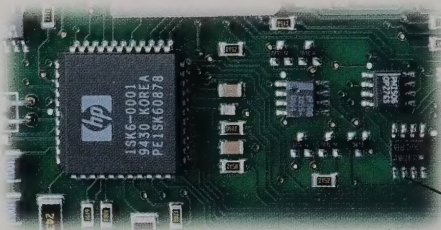


# Here's what happened when we put

Some interesting things happened when we made engineers responsible for lowering the costs of our basic instruments. They didn't skip QA testing, compromise performance, or resort to cheap materials.

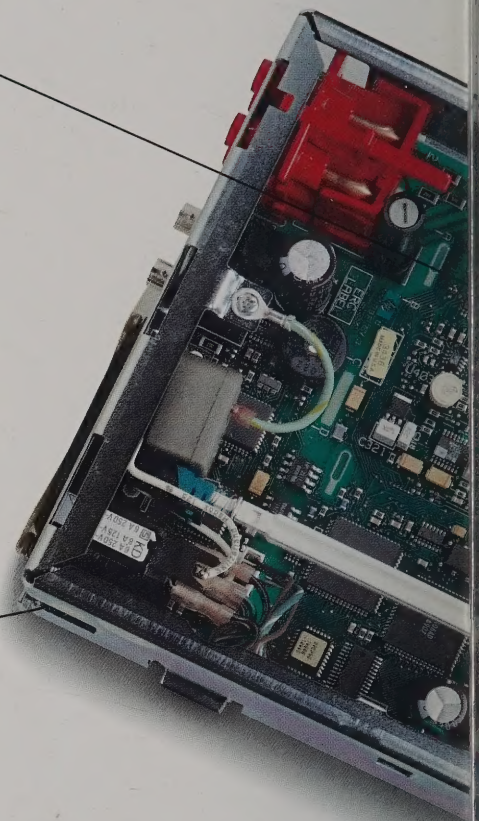
They designed new integrated circuits to replace piles of discrete components. They made instruments easier (and faster) to assemble. They took technology developed for our high-end products and adapted it to basic instruments.

The result? Instruments that fit today's tight budgets without compromising your need for performance and reliability.



## Benefit from advanced technology without paying for it.

Our engineers routinely borrow components, algorithms and design ideas developed for HP's top-of-the-line instruments to give you great performance at lower prices. The analog-to-digital converter in the HP 34401A DMM, for instance, is a scaled version of the ADC in our high-performance HP 3458A.



## Within budget, without compromise.

All instruments in this catalog are manufactured at sites that have been ISO-9002 certified and are CFC-free.

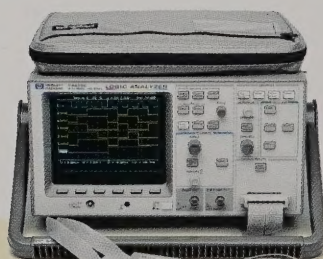
## You'll spend less because we spend less.

With a new design that cuts assembly time, incorporates custom ICs to reduce the parts count, and simplifies QA testing, we spend less building the HP 34401A (from 20 minutes down to 6!). These design changes improve performance and reliability, too.

## Contents



Oscilloscopes . . . 4-10  
HP 54600-series



Logic Analyzers . . . 11-15  
HP 54620A/C, HP 1664A



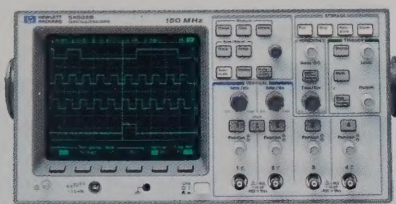
Multimeters . . . 16-21  
HP 34401A, HP 970-series



Function Generator . . . 22-23  
HP 33120A



# engineers in charge of cost control.



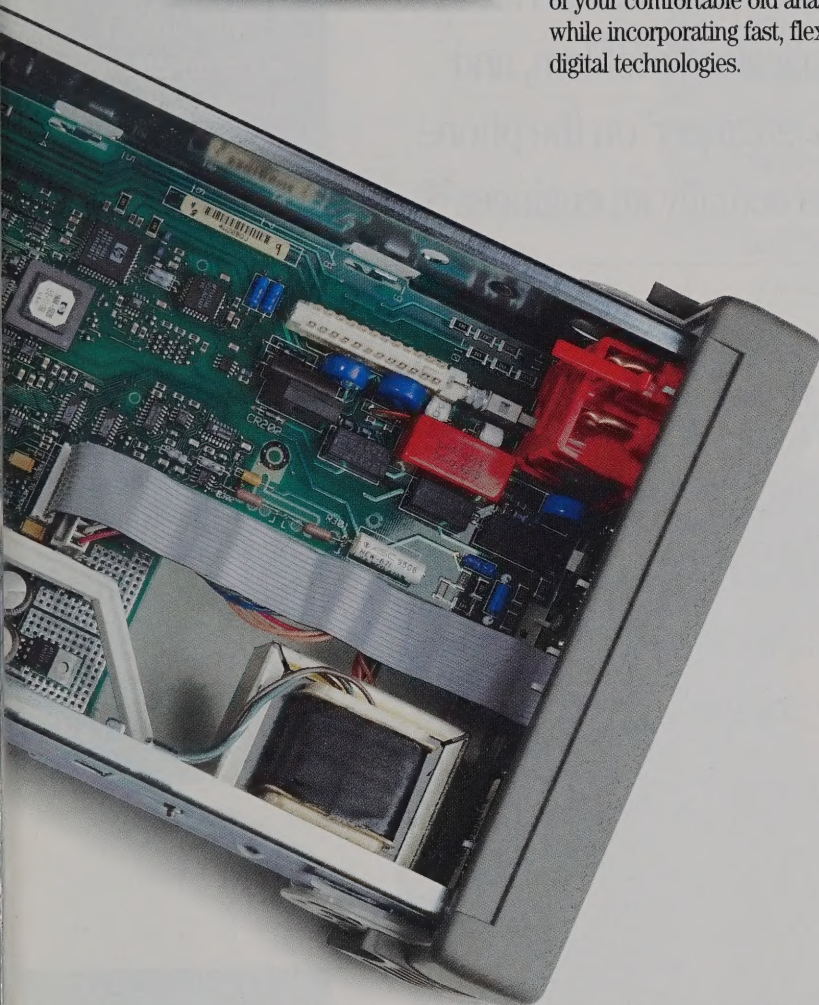
You did a nice job of designing these.  
Thanks.

You're not bashful about telling us what you like and don't like. That's why the HP 54600-series scopes, for instance, preserved the look and feel of your comfortable old analog scope while incorporating fast, flexible digital technologies.

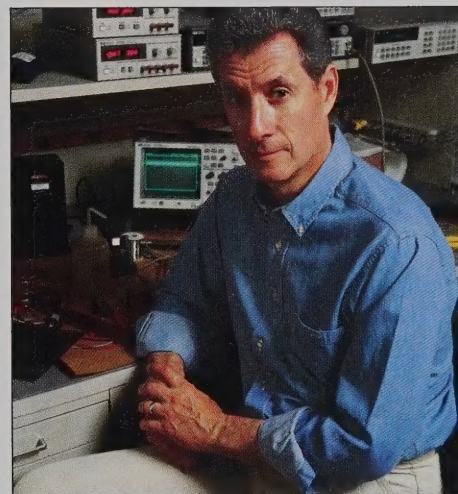


If you can change, so can  
your instruments.

One of your biggest gripes is getting stuck with equipment that no longer meets your needs. Basic instruments grow along with you, whether it's a scope module to add new measurements or HP BenchLink software to create new test capabilities.



*“When HP said they had low-cost instruments, my first reaction was ‘Yeah, right. What did you leave out?’ But the HP 34401A DMM was everything HP promised it would be.”*



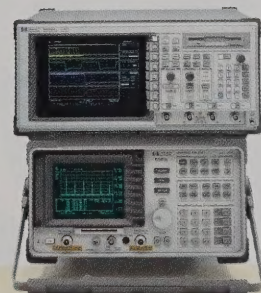
Counters . . . . .24-25  
HP 53100-series



Power Supplies . . . . .26-29  
HP E3600-series



Connectivity . . .30-33  
Cables, HP-IB cards,  
HP BenchLink software

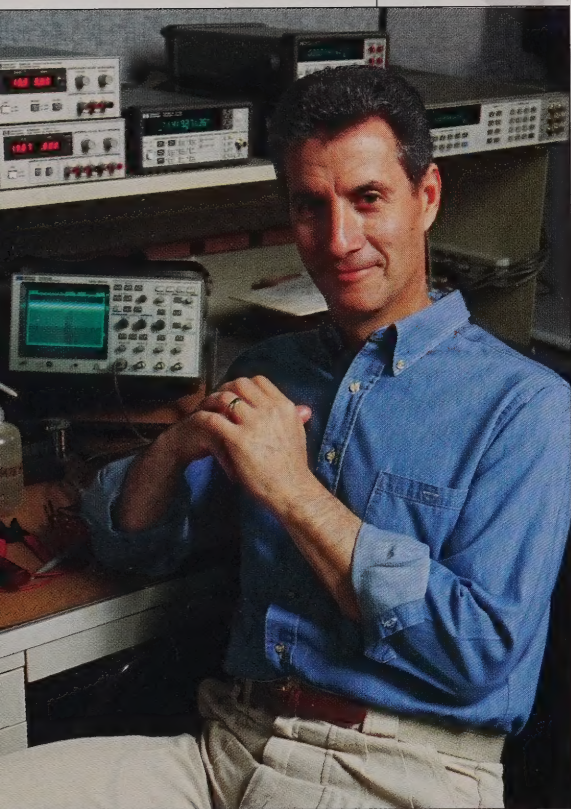


RF Products . . .34-35  
Extra Performance . . .36-37

When your needs extend into RF or high-performance measurements.



# And here's what happened when



“Now there's a switch. I called in to discuss an application problem, and the 'engineer' on the phone was actually an engineer.”

The experienced engineers on-line at HP DIRECT know how to make the measurements you need to make.

“When I need to compare products, the engineers at HP DIRECT know how their equipment stacks up against the competition.”

Get the data you need by phone, fax, mail or on the Net.

“I have zero time to spend on the phone. When all I need is a data sheet or something simple like a connector, HP DIRECT takes care of me without wasting my time.”

You won't find any 30-minute answers to 30-second questions here.



# we put engineers on the phones.

## We're ready for your toughest questions.

When you call HP DIRECT, you can talk with engineers like Scott DeBenning. Scott got his BSEE from Cal State Hayward, and he's been with HP ever since—14 years now. He knows these tools inside and out, and he knows the people who design and build them. In other words, if you have questions, Scott has answers.



What do you need? A cable?  
Performance specs? Consultation with an engineer?  
HP DIRECT is the one information resource for all  
your basic instrument needs.

**1-800-452-4844**

PAGE



## HP 54600-series scopes

# The feel of analog and the power of digital.

Digital scopes used to present a dilemma. Most engineers and technicians appreciated the performance and analysis benefits that only digital could provide, but they didn't want to give up the comfortable look and feel of analog scopes.

With the HP 54600-series scopes, that dilemma disappears. We wrapped the hands-on feel of analog around the power of digital processing, so you no longer have to choose one or the other.

### Start with what you love about analog.

When you're troubleshooting, you want to stay focused on two things: the circuit and the display. You don't want to waste time punching buttons or waiting for the scope to update. That's why the straightforward front panels and real-time display response of analog scopes made them such vital pieces of equipment.

You'll feel right at home with the HP 54600-series digital scopes because they preserve the easy usability of analog. Front-panel knobs look and work just like the knobs on your old analog scope. You don't have to change the way you work, which means you won't lose time getting used to a new style of test equipment.

An update rate of up to 1.5 million points per second or 60 screens per second (vectors-on mode) means these scopes respond instantly. When you make a change on the front panel, or your input signal changes, you'll see the results without delay.

The new real-time vector display

You'll love using these scopes.

1-800-452-4844

HP 54600-series starts at \$1,995

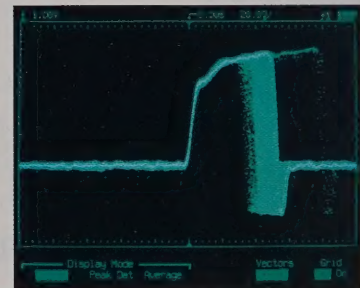
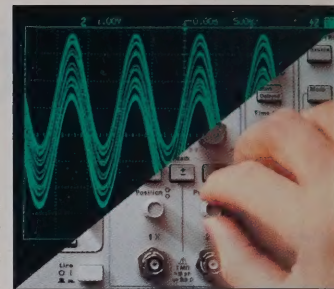
mode on the HP 54600-series makes your signal even easier to see. Slowly changing portions of waveforms appear brighter on the display, while rapidly changing portions appear dimmer. No

other digital scopes produce waveforms that provide this much visual information or look this close to analog.

### Add the punch of digital.

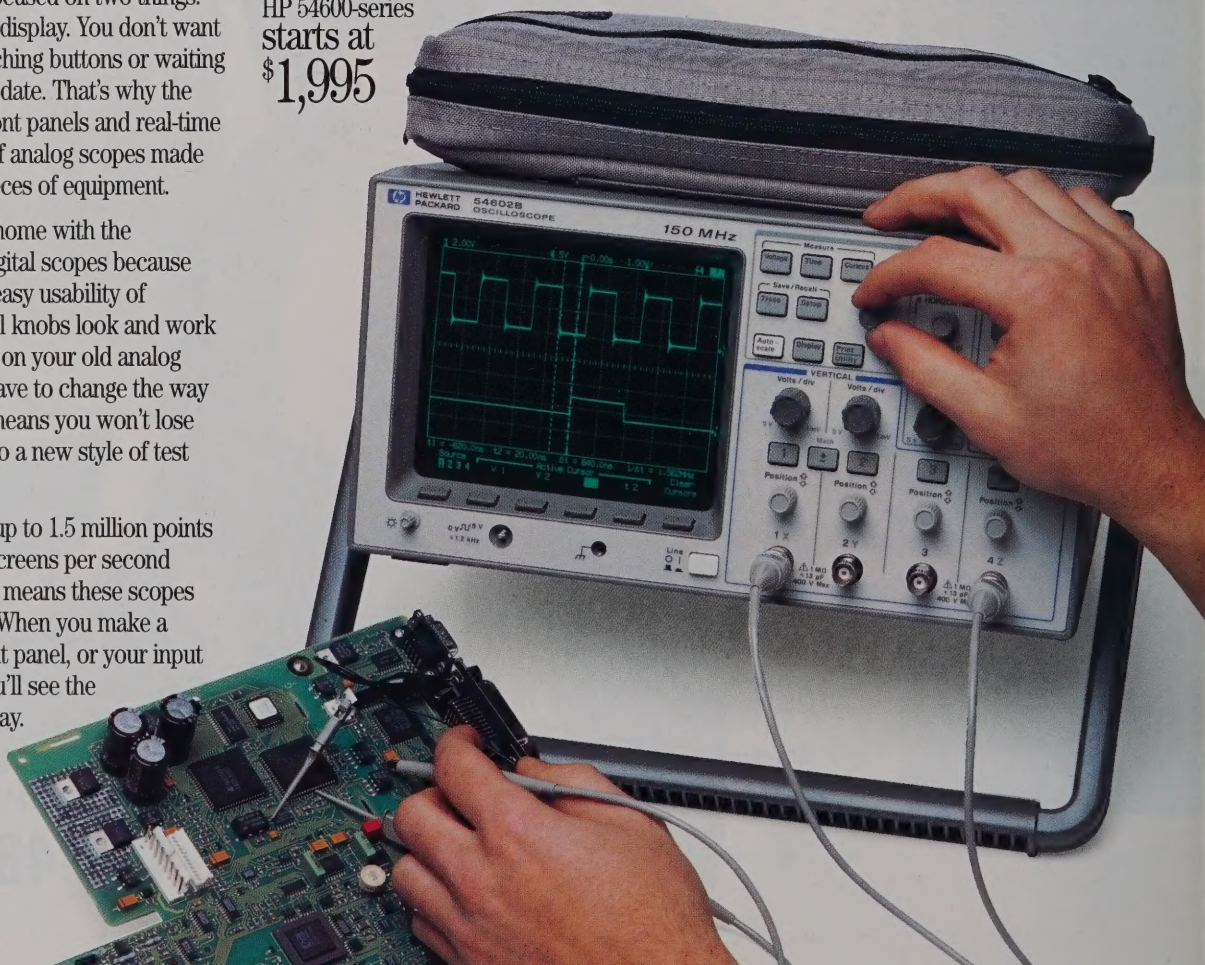
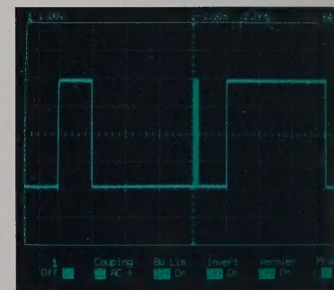
Why put up with faint traces or flickering displays? These digital displays are bright and stable, so there's no squinting, no need for a viewing hood, no more headaches. You'll see what you need to

Turn a control knob and your scope reacts instantly.



Autostore shows you signals you can't even see on an analog scope.

Real-time vector display and storage capture glitches other scopes miss.





# HP Basic Instruments

Making advanced  
technology work  
for you.

**H P D I R E C T**

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## **HP 54615B Oscilloscope:**

The first scope in this price  
range optimized for *both* signal  
acquisition and signal display.



## HP 54600-series scopes

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The new real-time vector display

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1-800-452-4844

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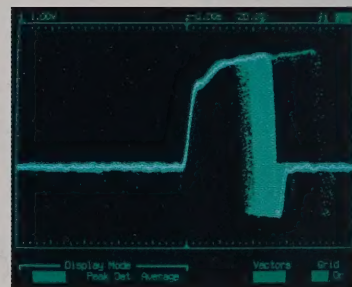
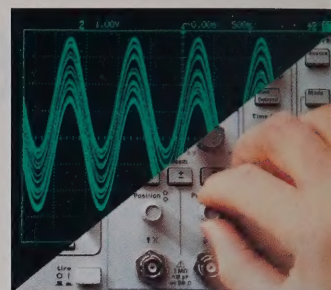
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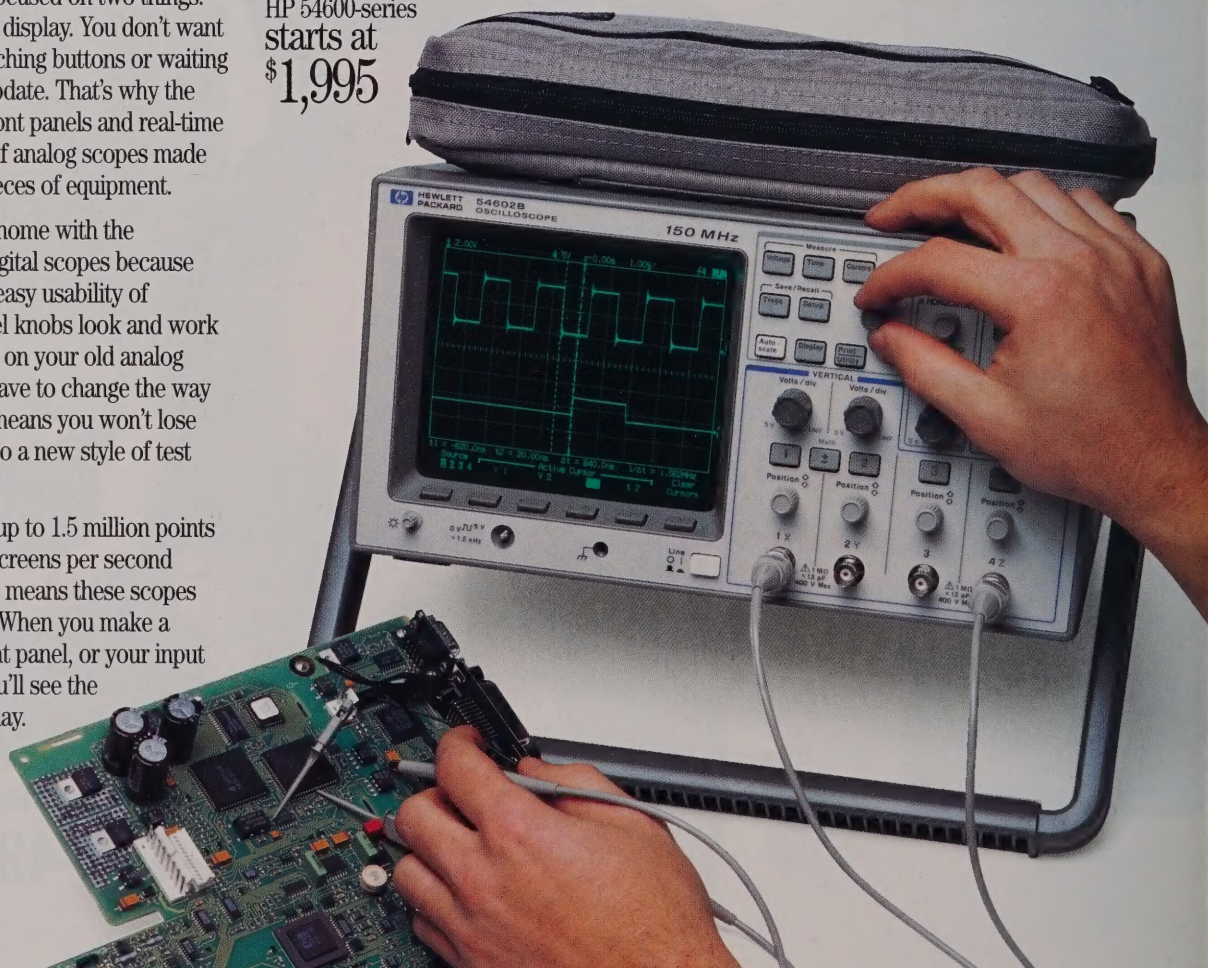
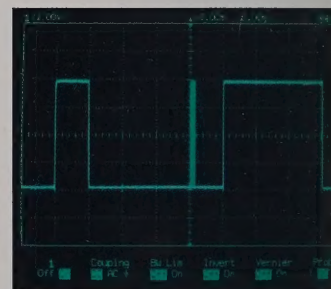
HP 54600-series starts at \$1,995

Turn a control knob and your scope reacts instantly.



Autostore shows you signals you can't even see on an analog scope.

Real-time vector display and storage capture glitches other scopes miss.





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**HP 54615B Oscilloscope:**  
The first scope in this price  
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## The two sides of scope performance.

When you think about digital scope performance, sample rate is the parameter that probably comes to mind. By acquiring samples faster, you naturally increase the information gathered with each acquisition. There is more involved than the maximum speed of the digitizers. The amount of information a scope acquires also depends on acquisition mode and memory depth. That is why the new HP 54615B not only utilizes two 1 GSa/s digitizers, but also has 5 K of memory and specialized digital peak-detect circuitry. The result is less chance you will miss the important details of your signal.

But even this expanded view of performance is only half the story. After a digital scope acquires a bunch of samples it has a lot more work to do, from scaling the data to transferring it to the display. All this takes time. If a scope does not have enough processing horsepower (most digital scopes use only one processor), it has to stop gathering new data while it processes old data. If your signals are not predictable and repetitive, you could miss critical events.

This is why the new HP 54615B, like all the models of the HP 54600-series, uses three processors. One manages signal acquisition, the second manages the user interface, and the third updates the display. All three processors work together to make sure you see more of the live signal.

Within budget,  
without compromise.



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Making advanced  
technology work  
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H P D I R E C T



1995

## HP 54615B Oscilloscope:

The first scope in this price  
range optimized for *both* signal  
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see, across a wide range of sweep speeds and input frequencies.

The power of digital opens up entirely new possibilities, such as pretriggering. Pretriggering lets you look back in time to see what was going on before the trigger event occurred.

Precise, dependable results are yet another benefit. With timebases of 2 ns/div (HP 54600B/01B/02B) or 1 ns/div (HP 54610B), you'll get more insight into waveform details. (Even the budget-priced HP 54603B offers a timebase of 5 ns/div — twice the speed of a leading competitor costing hundreds of dollars more.) Plus, horizontal accuracy of  $\pm 0.01\%$  delivers more dependable results than analog scopes. Now you can measure critical timing specs more accurately and, using the 1 ns/div timebase of the HP 54610B, catch the fast edges of ECL.

#### Seeing and storing your toughest signals.

The definition of good test equipment is that it helps you get your job done easier and faster.

- Autoscale frees you from resetting the scope every time you move the probe from test point to test point. Simply hit the Autoscale button, and it sets voltage, time and trigger parameters for you, almost before your finger is off the button.
- With autostore, the current waveform displays at full brightness while previous waveforms stay on the screen at half brightness, so it's easy to see history and the current trace at the same time.
- When you're on a slow sweep speed, peak detect helps capture fast transient events you might otherwise miss.
- With the speed to catch repetitive signals at up to 10 GSa/s (and single-shot signals at up to 20 MSa/s), you'll get a complete picture of what's happening in your circuits.

#### Your analysis doesn't have to end with a trace on the display.

With HP 34810A BenchLink Scope, it's easy to move data from your scope to a PC and take advantage of all the analysis, documentation and presentation tools offered in Microsoft Windows.



Microsoft Windows is a U.S. trademark of Microsoft Corporation.

*Interested in a low-cost way to boost your scope's performance and your own productivity? Page 8 shows how easy it is to add enhancement modules, and page 30 explains how HP BenchLink Scope lets you quickly move data and screen images from your scope to your PC — with no programming!*



## The power behind the performance.

Catching fast transients and updating 1.5 million display points every second are not jobs for an ordinary oscilloscope. Performance at this level demands a high-throughput architecture that moves data and control signals without delay.

The HP 54600-series scopes achieve this level with the help of two custom processors that work in tandem with the main processor. One manages data collection and placement mathematics, and the other is dedicated to display processing and waveform imaging functions.

With these two processors handling data, the main processor is free to take care of the front panel. By managing all these tasks in parallel, the digital electronics in the HP 54600-series boost both performance and responsiveness. It's another great example of superior engineering creating high-value products.

*Scott DeBenning  
BSEE  
California State University*

## Within budget, without compromise.

*See pages 6 and 7 for the full selection of HP 54600-series scopes.*



# 1 GSa/s sampling, 500 MHz bandwidth, 1 ns peak detect — and display speed to match.

\$6,995

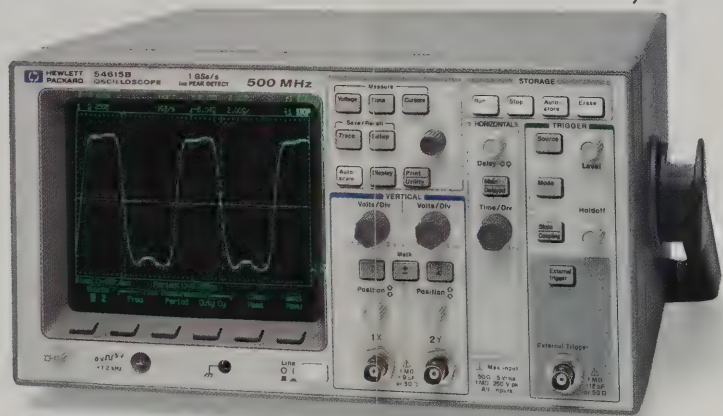
Ever wonder what the rest of your signal looks like?

With 1 GSa/s sampling on both channels, 500 MHz repetitive bandwidth and 1 ns peak detect, you'll finally have a scope that shows you the edges, glitches and fine detail in your signals. And not only does the HP 54615B scope acquire signals at high speed, it displays them faster than any scope in this price range.

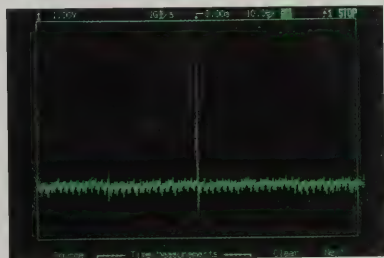
Peak detect you can trust at any sweep speed.

Many scopes offer good sample rate performance at fast sweep speeds but run into trouble as you slow the sweep down. (If you're curious, the problem is memory. If you tried to maintain a 1 GSa/s sample rate on a 100 ms/div sweep, for instance, you'd need a *gigabyte* of memory.) That's why you find scopes with high sample rates that can't maintain that sample rate at all sweep speeds. The risk, of course, is that you'll miss critical glitches whenever you use a slow sweep speed.

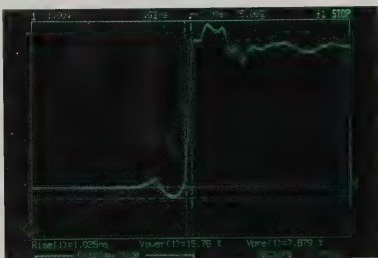
The solution is specialized digital peak-detect circuitry that captures glitches at the scope's full sample rate, regardless of the sweep speed. No matter how slow you sweep the HP 54615B scope, it can still detect glitches as narrow as 1 ns. (Be sure to read the fine print when comparing a scope's performance; not all implementations of peak detect work at all sweep speeds.)



Fast signal acquisition and dependable display performance mean you can stop wondering if you're seeing everything going on in your signals.



Even at slow sweep speeds, the HP 54615B scope still offers 1 ns peak detect.



With a 1 GSa/s sample rate, you won't miss important signal details.

Signal acquisition performance is only half the answer.

High sample rates always sound impressive, but consider the amount of data that's involved here: 1 GSa/s means a billion data points every second. No wonder ordinary scopes get bogged down and

Ready for results you can count on?

1-800-452-4844

ignore the input signal while they struggle to catch up.

The HP 54615B scope's multi-processor architecture lets it acquire, process and display data blocks in parallel. So unlike single-processor scopes, it doesn't turn its back on the real world while trying to update the display.

HP 54615B Oscilloscope			
Maximum sample rate	1 GSa/s on both channels		
Record length	≤5,000 points		
Number of channels	2		
Input impedance	1 MΩ, approx. 9 pF, or 50 Ω selectable		
Maximum input	250 V (dc + peak ac) or 5 Vrms in 50 Ω mode		
Resolution	8 bits		
<b>Vertical system</b>			
Bandwidth**	dc-500 MHz	dc gain accuracy*	±2%
ac coupled	10 Hz-500 MHz	Vernier accuracy*	±2%
<b>Horizontal system</b>			
Accuracy	±0.005%	Resolution	20 ps
Timebase range (main & delayed)	1 ns/div to 5 s/div		
<b>Trigger system</b>			
Sensitivity	dc to 100 MHz	100 MHz to 500 MHz	
	0.5 div or 5 mV	1 div or 10 mV	
<b>Power</b>			
	Voltage: 100-240 Vac, 45-440 Hz, 300 VA maximum		
<b>Size (excl. handle)</b>			
	172 mm H x 322 mm W x 317 mm D (6.8 x 12.7 x 12.5 in)		
<b>Net weight</b>			
	6.2 kg (14 lbs)		
<b>Ordering information</b>			
HP 54615B Two-channel 1 GSa/s oscilloscope	\$6,995.00 ea.		
HP 54650A HP-IB Interface module	485.00 ea.		
HP 54652B RS-232/Parallel Interface module	485.00 ea.		
HP 54657A HP-IB Measurement/Storage module	765.00 ea.		
HP 54659B RS-232/Parallel Measurement/Storage module	765.00 ea.		
<b>Options</b>			
005 Enhanced TV/video triggering	510.00 ea.	104 5041-9409 Carrying case	\$219.00 ea.
Trigger on specified video line number		1CM5062-7345 Rack mount kit	260.00 ea.
090 Delete probes	-306.00 ea.	106 HP 34810A BenchLink Scope software for Windows (HP BenchLink version 1.4 or later)	295.00 ea.
101 HP 10098A Accessory pouch and front panel cover	51.00 ea.		
103 HP 54654A Operator's training kit	204.00 ea.		
* Temperature ±10 °C from calibration.			
** Upper bandwidth reduced 2 MHz per degree Centigrade above 35°C.			

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\*\* Upper bandwidth reduced 2 MHz per degree Centigrade above 35°C.

The combination of fast sample rate, peak detect, and data-processing architecture is the only way to have complete confidence in the signals you're seeing on the display.

Finally, a high-performance digital scope that works with you, not against you.

When you're troubleshooting a circuit, the last thing you need is distractions — including a scope that's hard to use or slow to respond to your commands. The

HP 54615B scope duplicates the responsive look and feel of classic analog scopes, with none of the maddening delay you'll find in other digital scopes. You can pay attention to your circuits and count on the HP 54615B scope to deliver fast, dependable answers.

Just like people, scopes need to earn your trust.

It's one thing to talk about confidence; delivering it is something else.

HP DIRECT is ready to boost your confidence in two ways: the HP 54615B digital scope and the experienced engineers waiting to help you select the right scope for your needs. The scope backs up its confidence claim with concrete facts, from the dedicated digital peak-detect circuitry that doesn't miss a beat at any sweep speed to the multiprocessor architecture that displays results without the dead time that plagues other digital scopes.

The HP DIRECT sales engineers back up our confidence claims with years of hands-on measurement experience. Whether you have general questions about applying digital scopes or want to compare the HP 54615B scope to the competition, we have the answers.

Bob Langenburg  
AAS/BS  
Southern Illinois University



Get fast answers to your questions, too.

1-800-452-4844

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## HP 54600-series scopes

# A scope that's ideal for your application and budget.

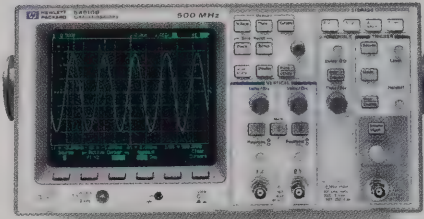
One message always comes through loud and clear from our customers: you're tired of having to choose between excellent features and performance at a reasonable price. You want it all.



### HP 54602B

- 150 MHz bandwidth
- 4 input channels
- Sweep speeds from 2 ns/div to 5 s/div
- \$3,395

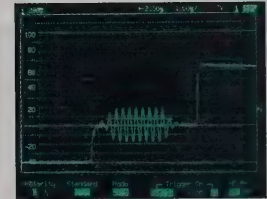
For a high-quality lab scope when your needs go past 100 MHz, take a closer look at the HP 54602B. You get the same capabilities as the other HP 54600-series scopes, with the added advantage of a 150 MHz bandwidth and 1 mV/div sensitivity.



### HP 54610B

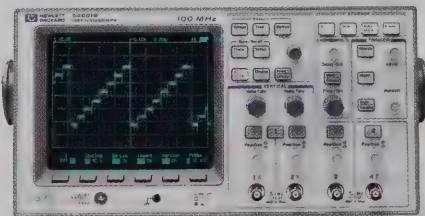
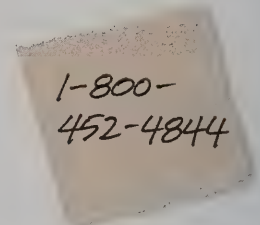
- 500 MHz bandwidth
- 2 input channels plus trigger view
- Sweep speeds from 1 ns/div to 5 s/div
- \$4,995

Need accurate 500 MHz measurements on a tight budget? We had you in mind when we designed the HP 54610B. With its horizontal accuracy of  $\pm 0.01\%$  and 1 ns/div timebase, you know you'll catch the critical details.



*If you're testing TV or video with the HP 54602B or HP 54610B scopes, you'll really want to see our powerful enhanced TV/video trigger option 005.*

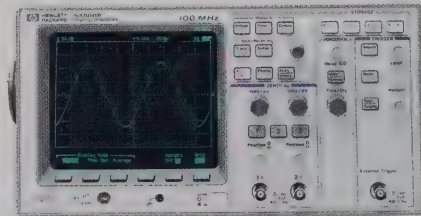
High performance  
at a price you wouldn't expect.  
Call HP DIRECT.



### HP 54601B

- 100 MHz bandwidth
- 4 input channels
- Sweep speeds from 2 ns/div to 5 s/div
- \$2,995

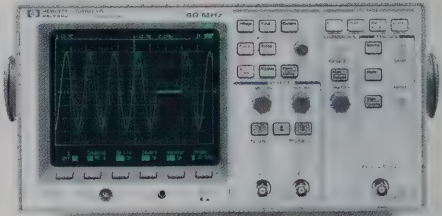
The HP 54601B offers tremendous value in a low-cost four-channel scope. When you need the added productivity and insight that come with four measurement channels, the HP 54601B offers an attractive blend of performance and capability.



### HP 54600B

- 100 MHz bandwidth
- 2 input channels
- Sweep speeds from 2 ns/div to 5 s/div
- \$2,495

The HP 54600B is ideal for production test, field service, and education, where you need solid, dependable scopes at a low price. With prices this low, you can afford to equip your staff without sacrificing measurement capability or confidence in the results.



### HP 54603B

- 60 MHz bandwidth
- 2 input channels
- Sweep speeds from 5 ns/div to 5 s/div
- \$1,995

Equipping a lab under tight budget restrictions used to mean giving up quality and capability. Not anymore. The HP 54603B delivers the features and performance you've always wanted. For colleges and universities, this scope is a great way to introduce students to the world of professional test equipment.



**HP 54600B, HP 54601B, HP 54602B, HP 54603B and HP 54610B Oscilloscopes**

	HP 54603B	HP 54600B	HP 54601B	HP 54602B	HP 54610B
<b>Bandwidth</b>					
CH 1 & 2	dc-60 MHz	dc-100 MHz	dc-100 MHz	dc-150 MHz*	dc-500 MHz
ac coupled	10 Hz-60 MHz	10 Hz-100 MHz	10 Hz-100 MHz	10 Hz-150 MHz*	10 Hz-500 MHz
CH 3 & 4	NA	NA	dc-100 MHz	dc-250 MHz	NA
<b>Single-shot bandwidth</b>	dc-2 MHz				
<b>Number of channels</b>	2	2	4 (2 + 2)	4 (2 + 2)	2
<b>Sensitivity</b>					
CH 1 & 2	2 mV/div to 5 V/div	2 mV/div to 5 V/div	2 mV/div to 5 V/div	1 mV/div to 5 V/div	2 mV/div to 5 V/div
CH 3 & 4	NA	NA	0.1 & 0.5 V/div	0.1 & 0.5 V/div	NA
<b>dc gain accuracy</b>	±2%	±1.5%	±1.5%	±1.5%	±2%
<b>Vernier accuracy</b>	±3.5%	±3%	±3%	±3%	±2%
<b>Rise time (calculated)</b>					
CH 1 & 2	<5.83 ns	<3.5 ns	<3.5 ns	<2.33 ns	<700 ps
CH 3 & 4	NA	NA	<3.5 ns	<1.4 ns	NA
<b>Input impedance</b>	1 MΩ, approx. 13 pF	1 MΩ, approx. 13 pF	1 MΩ, approx. 13 pF	1 MΩ, approx. 13 pF	1 MΩ, approx. 8 pF or 50 Ω selectable
<b>Input coupling</b>					
CH 1 & 2	dc, ac or ground	dc, ac or ground	dc, ac or ground	dc, ac or ground	dc, ac or ground
CH 3 & 4	NA	NA	dc, ground	dc, ground	NA
<b>Maximum input (dc + peak ac)</b>	400 V	400 V	400 V	400 V	250 V or 5 Vrms in 50 Ω mode
<b>Timebase range (main &amp; delayed)</b>	5 s/div to 5 ns/div	5 s/div to 2 ns/div	5 s/div to 2 ns/div	5 s/div to 2 ns/div	5 s/div to 1 ns/div
<b>Trigger sources</b>	CH 1, 2, line, or ext.	CH 1, 2, line, or ext.	CH 1, 2, 3, 4, or line	CH 1, 2, 3, 4, or line	CH 1, 2, line, or ext.

**HP 54600-series family**

<b>Accuracy</b>	±0.01%
<b>Vernier accuracy</b>	±0.05%
<b>Resolution</b>	100 ps
<b>Trigger sensitivity</b>	
dc to 25 MHz	0.35 div or 3.5 mV
dc to max. bandwidth	0.35 div or 3.5 mV**
<b>Maximum sample rate</b>	20 MSa/s single shot, 10 GSa/s repetitive
<b>Record length</b>	4,000 points (2,000 points single-shot or vectors on)
<b>Resolution</b>	8 bits
<b>Max. display update rate</b>	1,500,000 points/sec
<b>Power</b>	Voltage: 100-240 Vac, 48-440 Hz, 220 VA maximum
<b>Net weight</b>	Approx. 6.2 kg (14 lbs)
<b>Size (excl. handle)</b>	172 mm H x 322 mm W x 317 mm D (6.8 x 12.7 x 12.5 in)
<b>Warranty</b>	3 years

**Ordering information**

HP 54600B Two-channel 100 MHz oscilloscope	\$2,495.00 ea.	090 Delete probes (HP 54600/01/02/03B)	-\$112.00 ea.
HP 54601B Four-channel 100 MHz oscilloscope	2,995.00 ea.	090 Delete probes (HP 54610B)	-\$306.00 ea.
HP 54602B Four-channel 150 MHz oscilloscope	3,395.00 ea.	101 HP 10098A Accessory pouch and front panel cover	51.00 ea.
HP 54603B Two-channel 60 MHz oscilloscope	1,995.00 ea.	102 2 addl. HP 10071A probes (HP 54601/02B)	112.00 ea.
HP 54610B Two-channel 500 MHz oscilloscope	4,995.00 ea.	103 HP 54654A Operator's training kit	204.00 ea.
<b>Options</b>		104 5041-9409 Carrying case	214.00 ea.
001 RS-03 Magnetic interference shielding added to CRT	102.00 ea.	1CM 5062-7345 Rack mount kit	260.00 ea.
002 RE-02 Display shield added to CRT to reduce radiated interference	355.00 ea.	106 HP 34810A BenchLink Scope software (Windows)	295.00 ea.
005 Enhanced TV/video triggering (HP 54602/10B)	510.00 ea.	(can also be ordered separately as HP 34810A)	
Trigger on specified video line number		W50 Additional 2-year warranty, available for HP 54600-series oscilloscopes starting at†	60.00 ea.
Full bandwidth vertical out on rear panel			

\* Maximum bandwidth on CH 1 & 2 is 100 MHz at 1, 2, and 5 mV/div.

\*\* For HP 54602B, sensitivity between 25 MHz and max. bandwidth on CH 1 & 2 is 1.5 div or 3 mV at 1, 2, and 5 mV/div.

† Call HP DIRECT for more information.

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I'll help you get the right scope.

You rely on your scope day in and day out, so you need an instrument that meets your needs in terms of both features and performance.

I know HP's scopes inside and out, and I know how they compare to other scopes on the market. Give me a call and let's discuss your applications. We'll make sure you get enough capability without paying more than you should. I can also help you pick out the right accessories, from cables to performance-enhancement modules.

Dennis Gonden  
BSEE  
California Polytechnic  
University



Call me with your toughest scope questions.

**1-800-452-4844**



# Boost scope performance without breaking your budget.

Modules range from **\$280** to **\$815**



**Now upgrading your scope is easy — and easily affordable.**

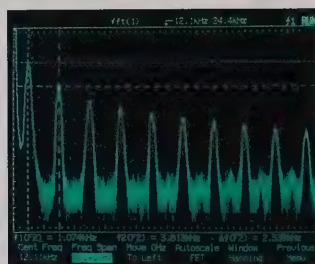
Transforming your HP 54600-series scope into a versatile test and measurement station is now as simple as popping on a module. It's easy to add direct hard copy, PC connectivity, RS-232 and parallel ports (depending on model), remote control, and advanced measurement capabilities such as fast Fourier transforms (FFT) and benchtop automation. You'll solve problems and boost productivity in ways that just aren't possible with ordinary scopes.

## **Put extra troubleshooting power in your lab.**

For high-performance tools usually found only in much more expensive scopes — including the FFT to view signals in the frequency domain — add the HP 54657A (HP-IB) or HP 54659B (RS-232 and parallel) measurement/storage module. Common problems that are difficult or impossible to see in the time domain (such as harmonic distortion) are much easier to analyze in the frequency domain.

**Get more from your oscilloscope.**

**1-800-452-4844**

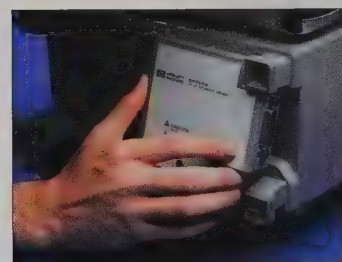


*Turn on FFT, check in the frequency domain, and track down the cause of circuit failures.*

## **Catch those intermittent failures.**

With this module's unattended signal monitoring and failure detection features, you simply set up the scope and walk away. It will monitor the signal by comparison to a waveform mask template. When the failure mode appears, the scope will capture the signal, then follow your instructions for printing or storing the signal for later analysis.

The measurement/storage module provides other features to make your work easier, including measurements of channel-to-channel delay and phase, user-definable voltage levels for timing measurements, and extended math functions and cursor readouts.



*Add remote control and connectivity, including a PC link to use HP's BenchLink Scope.*

## **Put system-style automation on your benchtop.**

Think of how much time you'd save if you could program a scope to perform repetitive tasks at the touch of a button.

The HP 54655A (HP-IB) or HP 54656A (RS-232) test automation module makes it easy to set up automated tests — and you don't need a computer to do it. A built-in mask generator and editor lets you create a test routine of up to 100 steps. You can even use branching on pass/fail conditions to guide the operator through troubleshooting.

If all you need is an interface, add HP-IB with the HP 54650A, parallel with the HP 54652A, or both RS-232 and parallel connections with the HP 54652B.





## HP 54600-series Scope Interface and Enhancement Modules

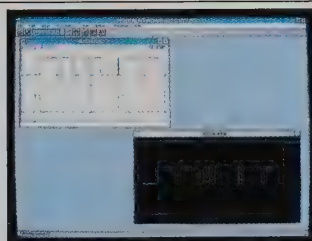
### Ordering information

Product*	Description	Price
HP 54650A	HP-IB Interface module	\$485.00 ea.
HP 54652A	Parallel Interface module	280.00 ea.
HP 54652B	RS-232 & Parallel Interface module	485.00 ea.
HP 54655A	HP-IB Test Automation module	765.00 ea.
HP 54656A	RS-232 Test Automation module	815.00 ea.
HP 54657A	HP-IB Measurement/Storage module	765.00 ea.
HP 54659B	RS-232 & Parallel Measurement/Storage module	765.00 ea.
HP 34810A	BenchLink Scope software for Windows	295.00 ea.

\*Modules with product numbers ending in "A" are compatible with HP 54600A-series and 54600B-series scopes. Modules ending in "B" are compatible with the HP 54600B-series only. (Note that the HP 54620A logic analyzer can use any of these modules, but it uses the modules for I/O only.)

Microsoft Windows is a U.S. trademark and MS-DOS is a registered trademark of Microsoft Corporation.

See page 33 for HP-IB and RS-232 cable needs.



*To quickly move data and screen images to your PC, see the HP 34810A BenchLink Scope software on page 30.*

## Modules: the right product for your test environment.

Budgets are getting tighter but the pace of the 1990s hasn't slowed a step. The bottom line is you have to do more with the same resources as last year.

Add-on modules for the HP 54600-series scopes are another way HP is working to expand your resources without breaking your budget. Modules keep high performance affordable, whether you're buying a new HP 54600-series scope or upgrading an existing one. You can buy the scope with confidence, knowing that you can expand its capabilities as your needs grow.

Give HP DIRECT a call, and we can tell you how to get more from less. We have a lot of hours in front of scopes ourselves, and we've helped customers with all kinds of scope applications. We'll show you how to maximize the performance and capability of your HP 54600-series scope — and make sure you get the right combination of modules and accessories.

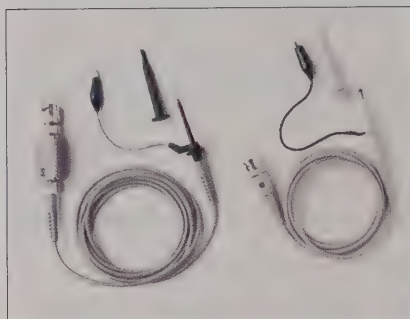
## Within budget, without compromise.

Need more on what modules will do for you? Call HP DIRECT.

# 1-800-452-4844



# Great measurements start with great connections.



**Connect to your circuits with top-quality probes.**

Complete your test setup with probes designed specifically for your HP 54500-series or HP 54600-series scope. The HP 10400-series miniature probes combine low capacitance with high performance. The HP 10070-series are rugged general-purpose probes for the HP 54600-series

scopes. They offer 1:1 or 10:1 division ratios, as well as a 500 MHz probe designed for the HP 54610B scope. For high-voltage measurements, the HP 1137A handles up to 5 kV.

## HP Scope Probes

Product	Typical bandwidth	Length (incl. cable)	Division ratio	Input resistance	Approximate shunt capacitance	Scope compatibility	Price
HP 10070A	20 MHz	1.5 m	1:1	1 M $\Omega$	70 pF	HP 54600/01/02/03B	\$56.00 ea.
HP 10071A	150 MHz	1.5 m	10:1	10 M $\Omega$	15 pF	HP 54600/01/02/03B	56.00 ea.
HP 10073A	500 MHz	1.5 m	1:1	10 M $\Omega$	12 pF	HP 54610B	153.00 ea.
HP 10430A	500 MHz	1 m	10:1	1 M $\Omega$	6.5 pF	HP 54500-series	179.00 ea.
HP 10437A	1 GHz	2 m	1:1	50 $\Omega$	NA	Scopes with 50 $\Omega$ inputs	128.00 ea.
HP 10438A	80 MHz	1 m	1:1	High Z	40 pF	Scopes with high-Z inputs	102.00 ea.
HP 10441A	500 MHz	2 m	10:1	1 M $\Omega$	9 pF	HP 54500-series	179.00 ea.
HP 10442A	1 GHz	2 m	10:1	500 $\Omega$	1.2 pF	Scopes with 50 $\Omega$ inputs	138.00 ea.
HP 10444A	500 MHz	1.6 m	10:1	1 M $\Omega$	6-15 pF	HP 54610B	179.00 ea.
HP 1137A	1 MHz	1.5 m	1000:1	500 M $\Omega$	3 pF	Scopes with 1 M $\Omega$ inputs	209.00 ea.

## The right accessories to be more productive.

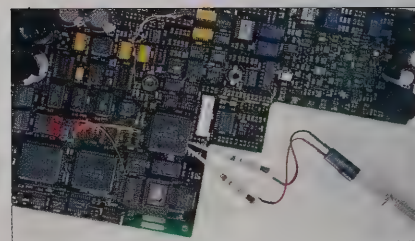


## HP Accessories

Product	Description	Price
HP 10072A	SMT kit for HP 10070-series probes; includes 10 SMT lead grabbers	\$66.00 ea.
HP 10450A	SMT kit for HP 10400-series probes; includes 10 SMT lead grabbers	82.00 ea.
HP 5081-7705	BNC adapter for HP 10070-series probes	28.00 ea.
HP 10100C	50 $\Omega$ Feedthrough termination BNC	56.00 ea.
HP 11094B	75 $\Omega$ Feedthrough termination BNC	37.00 ea.
HP 10110B	Dual banana to BNC (m) adapter	27.00 ea.
HP 1251-2277	Dual banana to BNC (f) adapter	15.50 ea.
HP 1183A	Testmobile scope cart for HP 54600-series scopes	495.00 ea.
HP 34397A	dc-to-ac inverter	160.00 ea.

### Tired of hauling around your scope?

Make your job easier and safer with the HP 1183A Testmobile, an economical cart custom-fitted for the HP 54600-series scopes.



The SMT kits include 10 SMT lead grabbers for fine-pitch circuitry.

Boost your measurement productivity with the right accessories.

# 1-800-452-4844



## HP logic analyzers

# Troubleshooting and design tools for a world gone digital.

### **Can you face the future with just your scope?**

It wasn't too many years ago that digital systems were the exception, not the rule. When you did run into digital circuits, you could conquer most of them with your trusty old scope.

Today, when even toasters have gone digital, it's a different story. Increasingly complex digital systems are everywhere, and your scope is having a hard time keeping up. Scopes are designed to provide a lot of detailed information about a small number of signals — just the opposite of what most digital measurements require.

### **The right tools for the digital world.**

In more and more situations, the right answer is to team your scope up with a logic analyzer. True logic analysis can make troubleshooting faster and more successful. You'll have the channels you need (from 16 to 136 or more), and you'll have the sequential and pattern triggering to isolate key events easily.

### **Logic analysis isn't what it used to be.**

We realize logic analyzers don't have a great reputation for cost-effectiveness or ease of use. Sure, if you designed processor-based systems all day long, it made sense to invest the time and money in a logic analyzer. If you needed a tool for occasional troubleshooting, however, a good scope was the sensible solution for logic analysis. Having only a few channels and limited triggering was a compromise, but at least your scope was easy to use.

### **Time to stop compromising, don't you think?**

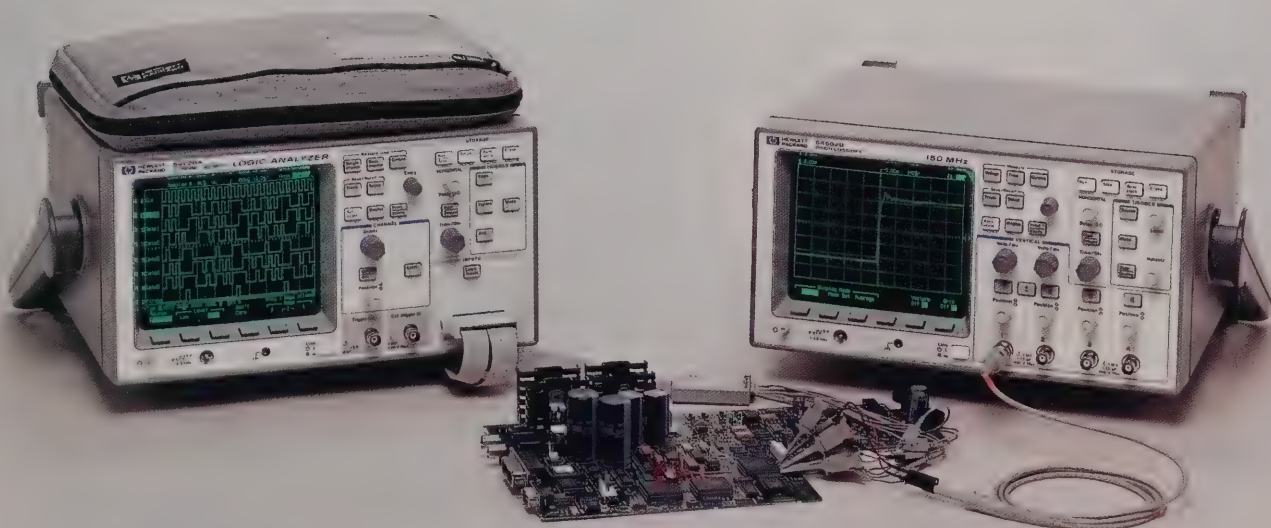
Now you can enjoy the benefits of logic analysis without all the learning and relearning. For quick troubleshooting on a wide variety of circuits and systems, the HP 54620A/C logic analyzer offers 500 MSA/s timing analysis on 16 channels, with the triggering you need to catch elusive events. And it's as easy to use as your scope — in fact, it's built on a scope platform, so you'll feel right at home right away.

For design and advanced troubleshooting of embedded microprocessor systems, the HP 1664A logic analyzer delivers both timing and state analysis. In other words, you not only see when things happen, you see what happens, too. You no longer have to guess what the hardware and software are up to. And the low price means you no longer have to do without this kind of power, either.

---

*See the HP 54620A/C on page 12  
and the HP 1664A on page 14 —  
and see how easy  
logic analysis  
can be today.*

---



*Scopes give you lots of detailed information about a few signals; logic analyzers give you quick status reports on a dozen or more signals at once. Successfully troubleshooting many of today's digital systems requires both approaches.*



# Looks like a scope, feels like a scope. Must be HP's newest logic analyzer.

For all those times you use a scope as a logic analyzer.

When you were growing up, didn't somebody always lecture you about using the right tool for the job? So why are you using a scope for those jobs where a logic analyzer is the right tool? Like piecemealing your way through an eight-line logic problem when you have only four channels. Or tracking down a glitch that's hiding in a timing sequence far too complex for your scope's triggering abilities.

We know why, because you've been telling us loud and clear. You'd use logic analyzers if they were less expensive, easier to learn, easier to set up, and easier to operate. In other words, if they were more like scopes.

Imagine: 16 channels of logic analysis, powerful triggering, and operation like a scope.

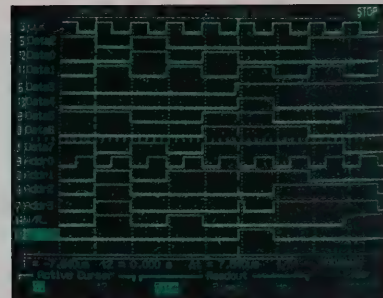
Think how easy it would be to troubleshoot complicated digital and mixed-signal circuits if you had 16 channels of powerful logic analysis and the ability to trigger on edges, patterns, duration times, and sequences.

The 500 MSa/s sampling rate gives you the power to catch the nastiest glitches. And you'll view the results on a sharp, high-speed display with an update rate of up to 15 screens per second, regardless of the number of active channels.

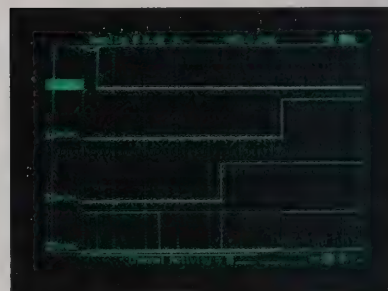
Add automatic measurements of frequency, period, duty cycle, width, delay and hold

It's a whole  
new way to  
look at logic.

1-800-  
452-4844



You've never done this on a logic analyzer — all active signals on the display, scaled for easy viewing, all with just one press of the Autoscale button.



Catch unstable and transient events, just like you would on your scope.

time, and you'll be ready to troubleshoot with speed and confidence.

For the ultimate in signal investigation, team the HP 54620A or HP 54620C with your scope, using the logic analyzer's advanced triggering to control the scope.



Get the familiar feel of a scope, with the triggering and channel count you need for complex digital troubleshooting.

Starting at  
**\$2,995**





#### HP 54620A/C Logic Analyzer

<b>Timing channels</b> Input R & C Maximum input	16 numbered 0–15 (all simultaneous) Approximately 100 k $\Omega$ and 8 pF $\pm 40$ V	Minimum input Threshold range	500 mVp-p about threshold $\pm 6.0$ V
<b>Timebase range</b> (main and delayed)	1 s/div to 5 ns/div		
<b>Timebase accuracy</b>	0.01% of reading		
<b>Timebase cursor accuracy</b> Single channel Dual channel	$\pm$ (sample period + 0.01% of reading + 0.2% of screen width) $\pm$ (sample period + 0.01% of reading + ch-ch skew + 0.2% of screen width)		
<b>Maximum sample rate</b>	500 MSa/s		
<b>Record length</b>	2 k for sample period $\geq 8$ ns (sweep speeds of 1 $\mu$ s/div to 1 s/div), 8 k for all other sweep speeds, and when auto glitch is disabled		
<b>Glitch detect</b>	Automatically activated when sampling period is slowed to be $> 4$ ns (1 $\mu$ s/div and slower). Minimum detectable glitch: 3.5 ns		
<b>Triggering sources</b>	All channels and external		
<b>Auto/normal operation</b> Autotrigger Normal	Free-running display if trigger not found Analyzer will wait indefinitely for trigger		
<b>Modes</b>	Edge, pattern, advanced (2 pattern and edge terms). Advanced operators: And, Or, Then, Entered, Exited, Duration ( $< >$ ) time, Occurs N times		
<b>Setup functions</b>	Autoscale, 16 saved setups, 2 trace memories, channel labeler (with 75 preset and user-defined labels)		
<b>Interface</b>	Compatible with HP 54650A, HP 54651A, and HP 54652B interface modules, and HP 34810A BenchLink Scope software		
<b>Net weight</b>	6.8 kg (15 lbs)		
<b>Size</b>	172.7 mm H x 322.6 mm W x 317.5 mm D (6.8 x 12.7 x 12.5 in)		
<b>Warranty</b>	3 years		
<b>Ordering information</b>			
HP 54620A 16-channel logic analyzer	\$2,995.00 ea.	HP 34397A dc-to-ac inverter	\$160.00 ea.
HP 54620C 16-channel logic analyzer	3,995.00 ea.	Opt. 104 5041-9409 Carrying case	214.00 ea.
Opt. 101 Accessory pouch and front panel cover	51.00 ea.	Opt. 106 HP 34810A BenchLink Scope software	295.00 ea.
Opt. 103 54654A Operator's training kit	204.00 ea.	Opt. 1CM 5062-7345 Rack mount kit	260.00 ea.

Did you know you can use BenchLink Scope to connect the HP 54620A to a PC? See page 30 for details.

#### Easy like your scope — and color makes it even easier.

You want to make measurements, not spend time learning how to operate a new instrument. That's why the HP 54620A and 54620C look, feel and run like scopes, from the familiar knobs to the one-button Autoscale feature.

And with the HP 54620C's full-color active matrix LCD display, you can simplify your analysis even more by highlighting particular signals or grouping sets of signals by color. It all adds up to an easier — and faster — way to get the job done.

## Admit it, you're skeptical.

When the design team first came to us with prototypes, we were skeptical, too. Then we tried it. This logic analyzer is so much like a scope that it's actually fun to use!

How did they do it? The high-throughput architecture and custom display processor of our HP 54600-series scopes provide the fast display updates and instant front panel response. And we use HP's unique "logic analyzer on a chip" — a 1.2 million transistor powerhouse — to handle the data acquisition.

Imagine what this can do for your troubleshooting. And then give us a call at HP DIRECT. We'll be happy to tell you exactly how it can be done.



How's this possible? It's easy. Let us show you how.

# 1-800-452-4844





Only \$4,600

Pick the mode of control that's fastest for you: front-panel, mouse, or PC-style keyboard.

## HP logic analyzers

# Don't let digital design problems destroy your schedule — or your budget.

Start with the right tools to solve problems in a hurry.

Whether you need to troubleshoot hardware, verify bus operation, or debug software, the HP 1664A logic analyzer offers comprehensive state and timing analysis and the advanced triggering you need for complex digital systems.

**A streamlined design for fast answers.**

Design problems are hard enough — don't choose a logic analyzer that makes things even worse. From the sensibly organized menus to the graphical trigger display that helps you set up any trigger sequence, the HP 1664A gets you to the solution sooner.

Having both state and timing analysis lets you see problems from more than one angle as you investigate signal timing, data flow or code execution. The chart mode converts streams of data into visual information, and the compare mode

Cut your digital design time.

1-800-  
452-4844

makes it easy to check prototypes against a verified master board. And the built-in disk drive lets you transfer data or graphics files to a PC for documentation or further analysis.

**The performance to stay ahead of your latest designs.**

Choose conventional timing mode for resolution down to

2 ns or transitional timing mode to analyze bursts of data as far as 34.3 seconds apart and up to 9.7 hours long. Transitional timing offers 8 ns resolution at 125 MHz on all channels or 4 ns on half channels, and the glitch timing mode detects intermittent signals as brief as 3.5 ns.

**Problems can't hide from this full-featured trigger.**

When problems are buried under layers of logic, you need triggering tools to dig down and root them out. The HP 1664A can trigger on timeout violations in real-time

Analyzer	Listing	IEEE 488	Markers	Find	X-pattern	from Trigger	Specify Patterns
ADDR	HP Inverse assembler for HP10	Time					
Hex	ATN Hexomic HEX EDI SRD REN IPE	Address					
-6	DFAF	50					-15.29
-5	DFEC	1B					-2.243
-4	DFDA	26					-2.055
-3	DFD4	0B					-1.909
-2	DFD3	30					-1.674
-1	DFAC	53					-1.375
0	DFDF	space	20				195.0
1	DFDF	space	20				745.0
2	DFD0	0	44				1.330
3	DFD0	1	40				1.810
4	DFD0	2	53				2.500
5	DFD4	K	40				3.090
6	DFD0	space	20				3.680
7	DFD0	0	44				4.267
8	DFD0	1	40				4.850

Tracing software execution and untangling bus communication are just two uses of the powerful state analysis tool.

applications and trace intricate algorithms. Twelve sequence levels for state triggering and ten levels of timing triggering make it possible to store or trigger on complex event series.



## HP 1664A Logic Analyzer

<b>State and timing channels</b>	34		
<b>Memory depth/channel</b>	4 K per channel, 8 K in half-channel mode		
<b>Timing analysis</b>			
Conventional mode	250 MHz all channels 500 MHz half channels		
Transitional mode	125 MHz all channels 250 MHz half channels		
Glitch mode	125 MHz half channels		
Sample period accuracy	±0.01% of sample period		
Channel-to-channel skew	2 ns typical, 3 ns maximum		
Minimum detectable glitch	3.5 ns		
<b>State analysis</b>			
Maximum speed <sup>1</sup>	50 MHz		
State clocks/qualifiers	2		
Setup/hold time <sup>2</sup>	0/3.5 ns through 3.5/0 ns, adjustable in 500 ps increments		
Minimum state clock pulse width	3.5 ns		
Time tag resolution <sup>3</sup>	8 ns or 0.1% (whichever is greater)		
Max. time count between states	34.4 s		
Max. state tag count <sup>3</sup>	4.29 × 10 <sup>9</sup> states		
<b>Triggering</b>			
Timing sequence levels	10		
State sequence levels	12		
Pattern recognizers	10		
Range recognizers	2, each 32 bits wide		
Edge/Glitch recognizers	2 (timing mode only)		
Max. occurrence counter value	1,048,575		
Timers	2		
Timer value range	400 ns to 500 s		
<b>Probes</b>			
Input resistance	100 kΩ, ±2%		
Input capacitance	~8 pF		
Minimum voltage swing	500 mVp-p		
Threshold range	±6.0 V, adjustable in 50 mV increments		
<b>Input/Output</b>			
I/O Ports	Centronics, RS-232, HP-IB and HIL for mouse and keyboard (optional)		
External arming	Input and output BNC connections with TTL signal levels		
Programmability	Fully programmable via RS-232 or HP-IB interface		
Mass storage	High-density, DOS/LIF format, 1.44 MB flexible disk drive		
File types	TIFF, PCX and PostScript screen image files, ASCII data files and binary-encoded data/configuration files		
<b>Physical factors</b>			
Dimensions	218 mm H x 440 mm W x 367 mm D (8.6 x 17.3 x 14.5 in)		
Weight	~11.8 kg (26 lbs)		
<b>Warranty</b>	1 year		
<b>Ordering information</b>			
HP 1664A 34-channel logic analyzer	\$4,600.00 ea.	HP E2427A HIL Keyboard kit	\$195.00 ea.
Opt. OB5 Service manual	55.00 ea.	HP 1180B Testmobile	290.00 ea.
Opt. UK9 Front panel cover	40.00 ea.	HP 35183A Work surface for HP 1180B	50.00 ea.
Opt. 1CM Rack mount kit	305.00 ea.		

<sup>1</sup>Maximum state analysis speed does not change when time tags or state tags are used.

<sup>2</sup>Minimum setup/hold window is specified for single-edge, single-clock acquisition. Single-clock, multi-edge setup/hold window is 4.0 ns. Multiclock, multi-edge setup/hold window is 4.5 ns.

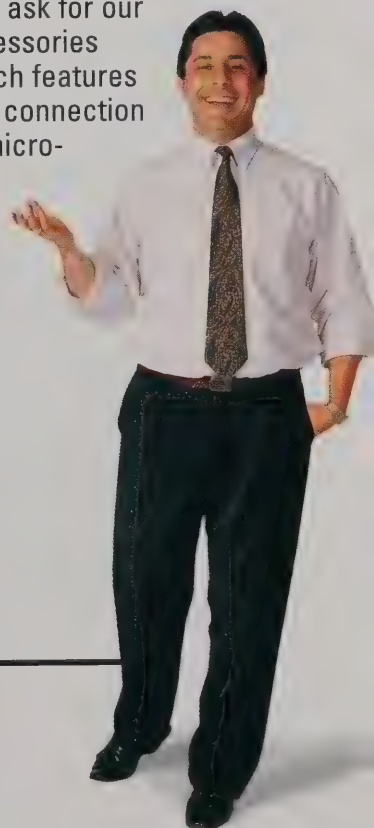
<sup>3</sup>Use of time tags or state tags will halve the memory depth.

## A solution for every digital design.

With all the customers we talk to, we know how diverse the field of digital design really is. The good news is that HP has a solution for virtually every digital application, from industrial automation to general-purpose computing.

The HP 1664A you see here is just one of the products in the HP 1660-series. Other analyzers in the family offer up to 136 channels, simultaneous state and timing analysis, and 100 MHz state analysis speed, giving you the power to handle the newest 32-bit designs. Some even provide built-in oscilloscopes to give both digital and analog views of suspect signals.

The engineers here at HP DIRECT are ready to answer your logic analysis questions — and be sure to ask for our free logic accessories brochure, which features more than 200 connection solutions for micro-processors and data buses.



We'll make sure you get the right digital tools.

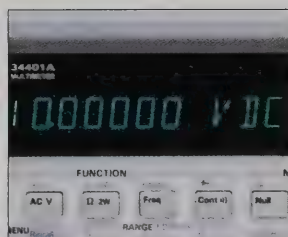
**1-800-452-4844**



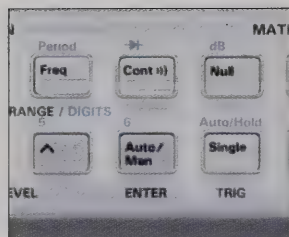
6½ digit  
accuracy  
at a 5½  
digit price.



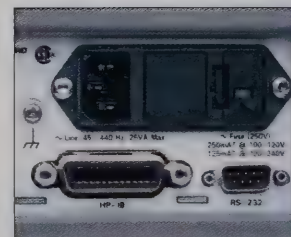
Only \$995



6½ digits means  
you'll catch  
details that other  
DMMs can't.



All the measure-  
ments you expect,  
plus features that  
make checkout on  
the bench easy.



Both HP-IB and  
RS-232C interfaces  
are standard.

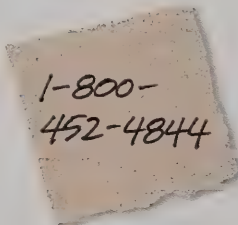
If you can find another DMM this  
accurate, it won't be this affordable.

Getting accuracy in a digital multimeter  
(DMM) used to mean spending big.  
Not anymore. For what you'd  
expect to pay for a 5½ digit  
DMM, you can now get the  
top-quality 6½ digit  
HP 34401A.

If people depend on you,  
depend on your HP 34401A.

With 6½ digits, you'll catch  
details that hide from lesser  
DMMs. And rest easy,  
knowing that the last  
measurement of the day will  
be as accurate as the first:  
24-hour accuracy is 0.0015% for  
dc volts and 0.06% for ac.

The highest-  
value meter in its  
class. Call:



Not just more features —  
more productivity.

Packing a DMM with features is fairly  
easy, but making those features work for  
you is another story. The  
HP 34401A boosts your  
productivity by combining  
time-saving features with an  
easy-access user interface.  
One or two button presses  
give you a wide array of  
functions, from dc volts to  
frequency to dB and dBm.  
Advanced tests include limit  
checks that can drive a TTL  
output, min/max/avg read-  
outs, and dc voltage ratios.

Plus, the HP 34401A offers up to 1,000  
readings per second and 50 range changes  
every second. You'll save time putting the  
HP 34401A into a system, too. Standard  
Commands for Programmable

Instruments (SCPI), HP 3478A, and  
Fluke 8840/8842A command languages  
are built in, so you won't have to rewrite  
your existing test software.

For a giant productivity leap, check out  
HP 34812A BenchLink Meter. This low-  
cost software package gives you graphing,  
basic statistics and data storage — with  
no programming.

**Chances are, you'll retire before it does.**

Unlike the short warranties on other  
DMMs, we back the HP 34401A for a full  
three years. (The secret behind our  
confidence: a mean-time-between-failure  
rating of 150,000 hours!)

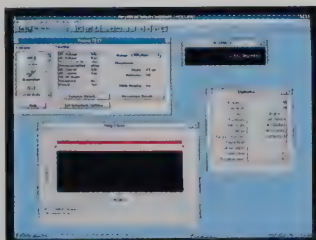


## HP 34401A Multimeter

Range	Resolution: 6½ digits (or freq. for ac volts)	Accuracy: 1 year ±(% of reading + % of range)	
<b>dc voltage</b>			<u>Input resistance</u>
100 mV	100 nV	0.0050 + 0.0035	10 MΩ or >10 GΩ
1 V	1 μV	0.0040 + 0.0007	10 MΩ or >10 GΩ
10 V	10 μV	0.0035 + 0.0005	10 MΩ or >10 GΩ
100 V	100 μV	0.0045 + 0.0006	10 MΩ
1000 V	1 mV	0.0045 + 0.0010	10 MΩ
<b>True rms ac voltage</b>			
100 mV	3 Hz–5 Hz	1.00 + 0.04	
	5 Hz–10 Hz	0.35 + 0.04	
	10 Hz–20 kHz	0.06 + 0.04	
	20 kHz–50 kHz	0.12 + 0.04	
	50 kHz–100 kHz	0.60 + 0.08	
	100 kHz–300 kHz	4.00 + 0.50	
for 1 V–750 V ranges	3 Hz–5 Hz	1.00 + 0.03	
	5 Hz–10 Hz	0.35 + 0.03	
	10 Hz–20 kHz	0.06 + 0.03	
	20 kHz–50 kHz	0.12 + 0.05	
	50 kHz–100 kHz	0.60 + 0.08	
	100 kHz–300 kHz	4.00 + 0.50	
<b>Resistance</b>			<u>Current Source</u>
100 Ω	100 μΩ	0.010 + 0.004	1 mA
1 kΩ	1 mΩ	0.010 + 0.001	1 mA
10 kΩ	10 mΩ	0.010 + 0.001	100 μA
100 kΩ	100 mΩ	0.010 + 0.001	10 μA
1 MΩ	1 Ω	0.010 + 0.001	5 μA
10 MΩ	10 Ω	0.040 + 0.001	500 nA
100 MΩ	100 Ω	0.800 + 0.010	500 nA
<b>dc current</b>	10 mA to 3 A ranges		
<b>ac current</b>	1 A to 3 A ranges		
<b>Frequency and period</b>	3 Hz (0.333 sec) to 300 kHz (3.33 μsec)		
<b>Continuity</b>	1000 Ω range, threshold variable from 1 Ω to 1 kΩ		
<b>Diode test</b>	1 V range, 1 mA test current		
<b>Math functions</b>	Null, min/max/avg, dBm, dB, limit test		
<b>Other features</b>	Automatic reading hold, 512 readings storage, dcV-dcV ratio		
<b>Maximum input</b>	dc and ac voltage	1000 Vdc, 750 rms ac	
	dc and ac current	3 A, from <250 V source, double fused	
<b>Shock and vibration</b>	meets MIL-T-28800D, Type III, Class 5		
<b>Power</b>	100/120/220/240 V, 45–65 Hz, 360–440 Hz		
<b>Net weight</b>	3 kg (6.5 lbs)		
<b>Size</b>	88.5 mm H x 212.6 mm W x 348.3 mm D (4 x 8.5 x 14 in)		
<b>Warranty</b>	3 years		
<b>Ordering information</b>			
HP 34401A Multimeter	\$995.00 ea.	HP 34130A Deluxe test lead set	\$35.00 ea.
Opt. 908 Rack mount kit	52.00 ea.	HP 34161A Accessory pouch	38.00 ea.
Opt. 910 Extra manual set	36.00 ea.	HP 34812A BenchLink Meter	150.00 ea.
Opt. W50 Additional 2-year warranty	45.00 ea.	HP 34397A dc-to-ac inverter	160.00 ea.

See page 33 for RS-232 and HP-IB cable needs.

Get the most from your meter! See pages 20–21 for probes and other accessories.

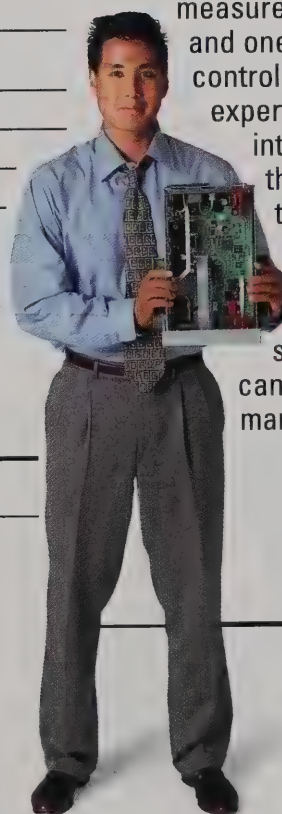


*For a giant productivity leap, check out HP 34812A BenchLink Meter on page 31. This low-cost software package gives you graphing, basic statistics and data storage — with no programming.*

## The engineering that makes it possible.

HP's full line of multimeters lets us leverage our engineering efforts across multiple products. The HP 34401A DMM is a great example. The designers started with the analog-to-digital converter they'd created for the 8½ digit HP 3458A DMM and scaled these techniques for the 6½ digit HP 34401A. Compared to the ADC in the HP 3478A DMM (the HP 34401A's predecessor), the result is a fivefold increase in accuracy and a tenfold increase in linearity — from an ADC that costs 60% less.

The HP 34401A's speed comes from three microprocessors: one for the data bus, one for measurement and timing, and one for display and control. Plus, our in-house experts in large-scale integration created three all-new ICs that consume less board space, boost performance, and at the same time significantly lowered our manufacturing costs.



Mick Asawasna  
BSEE  
California State University

Specs? Performance issues? Call HP DIRECT.

**1-800-452-4844**



# Putting benchtop features in the palm of your hand.

**\$290**

These compact multimeters will perform as well as your bench meter, without emptying your pockets.

The HP 970-series offers the basics and a whole lot more. Check out the high-resolution temperature function, the autodiode feature that automatically reverses polarity, and the min/max feature that alerts you when a minimum or maximum is recorded.

Rely on basic dc accuracy up to 0.05%, frequency response to 100 kHz, and true rms with ac + dc for higher accuracy on nonsinusoidal waveforms. Dig deep with resolution as tight as 10  $\mu$ V.

Measure with confidence, too. The innovative safety shutter prevents accidental connection to the current terminals, and all models feature high-energy fuses and overload alarms.



The protective boot keeps your handheld safe so you can focus on your work.



The HP 974A has the resolution of a  $4\frac{1}{2}$  digit display and, unlike some other  $4\frac{1}{2}$  digit handhelds, the accuracy to back it up.

**\$370**



**The HP 973A gives you more ways to test and troubleshoot.**

The  $3\frac{1}{2}$  digit display (with 0.1% basic dc accuracy), 20 kHz frequency range, true rms, and ac + dc let you measure with confidence. Plus dBm and relative dB with dynamic range of 57 dB (2 mV to 400 mV) or 74 dB (0.2 V to 1000 V), with 0.1 dB resolution.

A convenient dual display makes it possible to view two digital readings simultaneously.

◀ When extra precision is required, so is the HP 974A.

The HP 974A's  $4\frac{1}{2}$  digit meter is as precise as you'll find, with a 49,999 count full scale.

Tough measurements? How about 100 kHz frequency response, true rms, ac + dc, and basic dc accuracy of 0.05% for all ranges.

**\$245**

Measure low-level signals with the HP 972A.

When you're chasing small signals, you'll appreciate 40 mV ranges for dc/ac voltage and the assurance of 20 kHz frequency response. And forget about using a dedicated capacitance tester: the HP 972A handheld multimeter can measure from 10 nF to 1000  $\mu$ F.



**\$195**

When things tend to get bumped and broken, there's no better handheld than the HP 971A.

Go ahead, toss the HP 971A in your tool box. Rubber seals protect it from the spills and thrills you face on the job.



HP's innovative safety shutter prevents inadvertent connection with current terminals.



# HP E2373A, HP 971A, HP 972A, HP 973A and HP 974A Handheld Multimeters

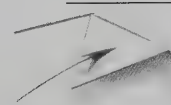
Model	HP E2373A	HP 971A	HP 972A	HP 973A	HP 974A
Display count	3,200	4,000	4,000	4,000	49,999
Basic accuracy					
dc voltage	0.7%	0.3%	0.2%	0.1%	0.05%
ac voltage	1.2%	1%	0.5%	0.7%	0.5%
Ohms	0.7%	0.5%	0.2%	0.2%	0.06%
Capacitance	—	—	1.2%	1.2%	—
Frequency response (ac volts)	500 Hz	1 kHz	20 kHz	20 kHz	100 kHz
Resolution/maximum					
dc voltage	100 $\mu$ V/1000 V	100 $\mu$ V/1000 V	10 $\mu$ V/1000 V	10 $\mu$ V/1000 V	10 $\mu$ V/1000 V
ac voltage	1 mV/750 V	100 $\mu$ V/1000 V	10 $\mu$ V/1000 V	10 $\mu$ V/1000 V	10 $\mu$ V/750 V
Ohms	0.1 $\Omega$ /30 M $\Omega$	0.1 $\Omega$ /40 M $\Omega$	0.1 $\Omega$ /40 M $\Omega$	0.1 $\Omega$ /40 M $\Omega$	0.01 $\Omega$ /50 M $\Omega$
Current	10 $\mu$ A/10 A	100 nA/10 A	100 nA/10 A	100 nA/10 A	10 nA/10 A
Elapsed time	—	1 min/1999 min	1 min/1999 min	1 min/1999 min	1 sec/9999 min
Frequency	—	1 Hz/100 kHz	0.01 Hz/200 kHz	0.01 Hz/200 kHz	0.01 Hz/200 kHz
Safety shutter		•	•	•	•
High-energy fuse, overload alert		•	•	•	•
Relative, percent		•	•	•	•
Min/max, average		•	•	•	•
Hold, autohold		•	•	•	•
Bargraph	•	•	•	•	•
Thermistor temp.		•	•	•	•
Thermocouple temp.				•	
Dual digital display			•	•	
True rms ac response				•	•
ac + dc				•	•
dBm/dB				•	•
Warranty	3 years				

## Ordering information

HP E2373A Handheld multimeter	\$99.00 ea.	HP E2304A Soft carrying case	\$19.00 ea.
HP 971A Handheld multimeter	195.00 ea.	HP E2306A Deluxe test lead kit	35.00 ea.
HP 972A Handheld multimeter	245.00 ea.	HP E2307A Thermocouple bead probe type-K (HP 973A only)	25.00 ea.
HP 973A Handheld multimeter	290.00 ea.	HP E2308A Thermistor temperature probe	35.00 ea.
HP 974A Handheld multimeter	370.00 ea.		
Opt. W50 Additional 2-year warranty	45.00 ea.		

Note: All HP 970-series multimeters have Vdc, Vac, ac/dc current, ohms, continuity, diode test, autodiode test, temperature °F and °C, frequency, auto/manual ranging, autopower off, secondary display for range and min/max, and 3-year warranty. Standard accessories include a pair of test leads, operating and calibration manual, Certificate of Calibration, spare fuse, and rubber boot. Two 1.5 V AA alkaline batteries installed.

The HP E2373A has Vdc, Vac, ac/dc current, ohms, continuity, diode test, auto/manual ranging, and a 3-year warranty. Standard accessories include a pair of test leads, manual, spare fuse, and installed batteries.



From spare leads to thermocouples — turn the page for must-have accessories.

Compare these DMMs with all the popular models on the market. And don't let a tight budget stop you; call HP DIRECT and ask about the HP E2373A — only \$99!

**1-800-452-4844**



**Within budget,  
without compromise.**



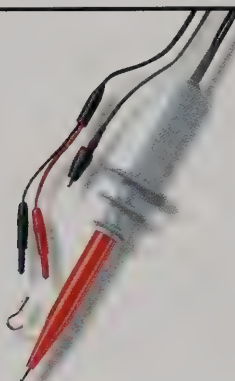
# Get the most from your handheld or HP 34401A multimeter with these accessories.



Test leads are 1.2 m (48 in) long with straight shrouded banana plug inputs. Kit comes in Velcro®-sealed pouch.

**HP 34130A Deluxe Test Lead Set.....\$35.00 ea.**

## Accessories for both your HP handheld multimeter and HP 34401A.



Bandwidth (~3 dB) 150 Hz 2% to 5% accuracy. For use with any DMM with 10 MΩ input resistance. 1000:1 division ratio.

**HP 34300A 40 kV ac/dc  
High-Voltage Probe .....\$90.00 ea.**



100 kHz to 700 MHz bandwidth. 0.25 Vrms to 50 Vrms range. +1 dB accuracy to 500 MHz, +2 dB to 700 MHz. 1 Vdc output for 1 Vrms input. For use with any DMM with 10 MΩ input resistance.

**HP 34301A 700 MHz RF Detector Probe...\$80.00 ea.**



+10 A ac or dc; or +100 A ac or dc probe. 1 kHz bandwidth. +1.0 Vdc output at 10 A or 100 A. +2% accuracy. 19 mm aperture.

**HP 34302A Clamp-on ac/dc  
Current Probe .....\$250.00 ea.**

## HP handheld multimeter accessories. Note: Type-K thermocouple probes are for use with HP 973A multimeter only.



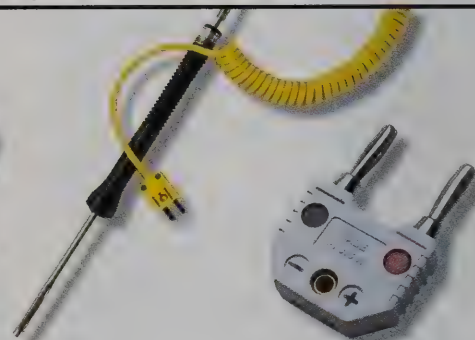
Padded case with dual zipper and snap-on belt strap.

**HP E2304A Handheld Multimeter  
Carrying Case .....\$19.00 ea.**



Test leads are 1.2 m (48 in) long with right-angle shrouded banana plug inputs. Kit comes in Velcro®-sealed pouch.

**HP E2306A Deluxe Test Lead Kit.....\$35.00 ea.**  
**HP E2305A Spare Test Leads (2 pairs).....\$15.00 ea.**  
*(not shown)*



Basic accuracy +2.2 °C (4 °F). Must use with HP E2303A adapter.

**HP E2301A Surface Type-K  
Thermocouple Probe .....\$120.00 ea.**

Used to connect type-K thermocouple probes to HP 970-series handheld DMMs.

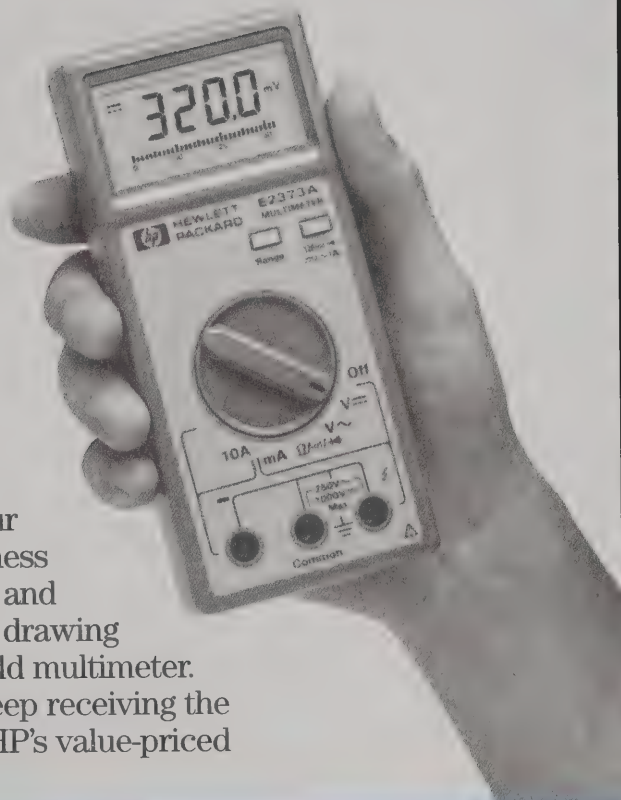
**HP E2303A SMP-to-Dual  
Banana Plug Adapter.....\$12.00 ea.**



# Win a FREE HP Multimeter!

Enter HP's  
monthly drawing  
for an HP 970-series  
handheld multimeter.

Seems like a fair trade —  
give us a few seconds of your  
time by sending us the business  
reply card on the next page, and  
we'll enter you in a monthly drawing  
for an HP 970-series handheld multimeter.  
Plus, we'll make sure you keep receiving the  
latest information on all of HP's value-priced  
basic instruments.



## While you're at it, feel free to do a friend a favor. For free.

Give us a name and address, and we'll make sure your friend or colleague  
gets the latest issue of the HP Basic Instruments Catalog, too.

Mr. Ms. Dr. (circle one)

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# We'll trade you this card for a chance at a FREE multimeter.

- ☐ YES! Send me the latest HP Basic Instruments Catalog. Please ADD me to your mailing list.
- ☐ UPDATE my address on your mailing list.
- ☐ Please DELETE me from your mailing list.

PLACE YOUR MAILING LABEL  
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(circle one)

Company \_\_\_\_\_ Dept./Bldg. Mail Stop \_\_\_\_\_

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City \_\_\_\_\_ State \_\_\_\_\_ ZIP \_\_\_\_\_

Telephone: Area Code (\_\_\_\_) \_\_\_\_\_ Extension \_\_\_\_\_

## Which of these electronic test instruments do you use, specify, or buy?

- 5709 ☐ Digital Multimeters
- 5703 ☐ Oscilloscopes
- 5702 ☐ Counters
- 5301 ☐ Pulse/Function Generators
- 5711 ☐ Bench Power Supplies
- 5710 ☐ System Power Supplies
- 5706 ☐ Logic Analyzers
- 5704 ☐ Meters
- 52 ☐ Data/Telecommunications Testers
- 5107 ☐ Microwave Power Meters
- 5105 ☐ Spectrum Analyzers
- 5106 ☐ Network Analyzers
- 5501 ☐ Data Acquisition & Control
- 5502 ☐ Dynamic Signal Analyzers
- 56 ☐ Computer-Aided Test Software
- ☐ Other

## Check the occupation which most closely describes your work:

- 11 ☐ Electrical Engineer
- 12 ☐ Mechanical Engineer
- 15 ☐ Industrial Engineer
- 1B ☐ Production Engineer
- 1E01 ☐ Engineering Technician
- 54 ☐ Purchasing Agent
- 51 ☐ Administrator
- 3 ☐ Information Systems
- 71 ☐ Teacher/Professor/Trainer
- 21 ☐ Scientist/Researcher
- ☐ Other

## Check the department in which you work:

- 32 ☐ Research & Development
- 31 ☐ Manufacturing
- 33 ☐ Quality Assurance
- 36 ☐ Equipment Maint./Calibration
- 26 ☐ Purchasing
- 21 ☐ General Mgmt./Admin.
- 41 ☐ Sales
- 42 ☐ Marketing
- 43 ☐ Service/Support
- 53 ☐ Education/Training
- ☐ Other

## Check the title which best describes your position:

- 1 ☐ Board Member/President/Owner
- 21 ☐ Vice President/Other Officer
- 22 ☐ General/Functional Manager
- 23 ☐ Middle Manager/Dept. Head
- 24 ☐ Supervisor/First-Level Manager
- 31 ☐ Project Leader
- 32 ☐ Individual Contributor/Staff
- ☐ Other

## Check the industry that best describes your company at your location:

### MANUFACTURING

- 32 ☐ Industrial Machinery & Equipment
- 33 ☐ Computer & Peripheral Equipment
- 35 ☐ Communications Equipment
- 36 ☐ Electronic Components
- 37 ☐ Automotive & Other Transport
- 38 ☐ Aerospace/Defense Equipment
- 39 ☐ Instrument Manufacturing
- 3A ☐ Consumer Electronics

### SERVICE

- 74 ☐ Electronic Equipment Rental
- 72 ☐ Research & Development Labs
- 82 ☐ Education

### GOVERNMENT/OTHER

- ☐ Government
- ☐ Other

## Number of employees at your business location:

- 1 ☐ 1-99
- 2 ☐ 100-499
- 3 ☐ 500-999
- 4 ☐ 1,000-4,999
- 5 ☐ 5,000-14,999
- 6 ☐ Over 15,000

9797





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Cordura® pouch fits on top of the HP 34401A DMM, the HP 53131/32/81A counter and the HP 33120A function/arb generator.

**HP 34161A Accessory Pouch .....\$38.00 ea.**



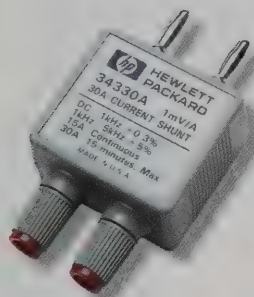
Works with any DMM with 4-wire  $\Omega$  function. Gold-plated flat tweezers ensure precise contact to the components being measured. Maximum input voltage is 42 V.

**HP 11059A Kelvin Probe Set .....\$135.00 ea.**



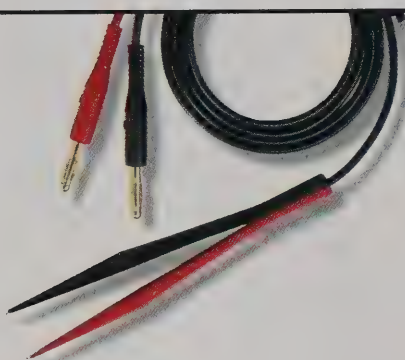
Two silver-plated flat tweezer clips to construct your own Kelvin probe set for 4-wire  $\Omega$  measurements.

**HP 11062A Kelvin Clip Set .....\$26.00 ea.**



1 mV/A output; 15 A continuous; 30 A for 15 minutes maximum.

**HP 34330A 30 A Current Shunt .....\$55.00 ea.**



Tweezer designed for easy access to surface mount components. Maximum voltage: 42 Vp.

**HP 11060A Surface Mount Device Probe .....\$24.00 ea.**



Low thermal jumpers to minimize error in low-voltage measurements.

**HP 11053A Lug-to-Lug Jumpers .....\$29.00 ea.**

**HP 11174A Lug-to-Banana Jumpers .....\$29.00 ea.**

**HP 11058A Banana-to-Banana Jumpers .....\$29.00 ea.**



Basic accuracy  $\pm 2.2^{\circ}\text{C}$  ( $4^{\circ}\text{F}$ ).

**HP E2307A Type-K Thermocouple Bead Temperature Probe .....\$25.00 ea.**



5 k $\Omega$  at  $25^{\circ}\text{C}$ . Basic accuracy  $\pm 0.2^{\circ}\text{C}$  ( $0.4^{\circ}\text{F}$ ).

**HP E2308A Thermistor Temperature Probe .....\$35.00 ea.\***



5 k $\Omega$  at  $25^{\circ}\text{C}$ . Basic accuracy  $\pm 0.1^{\circ}\text{C}$  ( $0.2^{\circ}\text{F}$ ).

**HP 40653B Surface Sensor Assembly with Thermistor .....\$62.00 ea.\***

\*For use only with the HP 970-series handheld multimeters.

Call a sales engineer to talk about any meter needs you have.

**1-800-452-4844**



# Custom waveform generation in a function generator at this price? Sure!

**\$1,725**

**What can you expect from a function generator this affordable? Everything.**

You know the feeling. You'd like to have more confidence in your test signals, but you can't afford one of those top-of-the-line function generators. Meet the HP 33120A function/arbitrary generator, with the rock-solid stability of digital synthesis at a price even your accounting department will feel good about.

And not only do you get better performance, you get arbitrary waveforms available for the first time in this price range. Just imagine the ways you could use complex custom waveforms, from simulating heartbeats and vibrations to testing circuits in ways never before possible at this price. With 12-bit resolution, 40 MSa/s, and storage for up to four 16 k-deep waveforms, you have nearly unlimited flexibility.

**Spectral purity this good means no hidden surprises.**

Low cost means messy harmonics and other extra baggage, right? Well, check out the harmonic distortion specs and

clear signals you get with the HP 33120A. Then try to find the same performance anywhere else at this price.

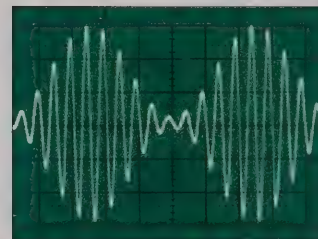
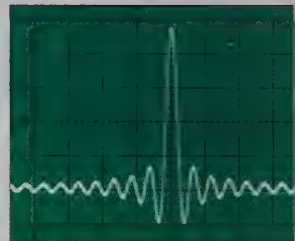
**Everybody promises functionality. But we made it effortless.**

In fact, you can access any of ten major functions with a single key press. Sweep and modulation expand your test options without expanding your equipment list. Plus you get full programmability using Standard Commands for Programmable Instruments (SCPI) with standard HP-IB and RS-232.

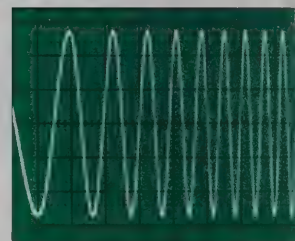
**Create any waveform you need. Call HP DIRECT.**

**1-800-  
452-4844**

*A built-in 16 k-deep arbitrary waveform generator handles your custom waveform needs.*

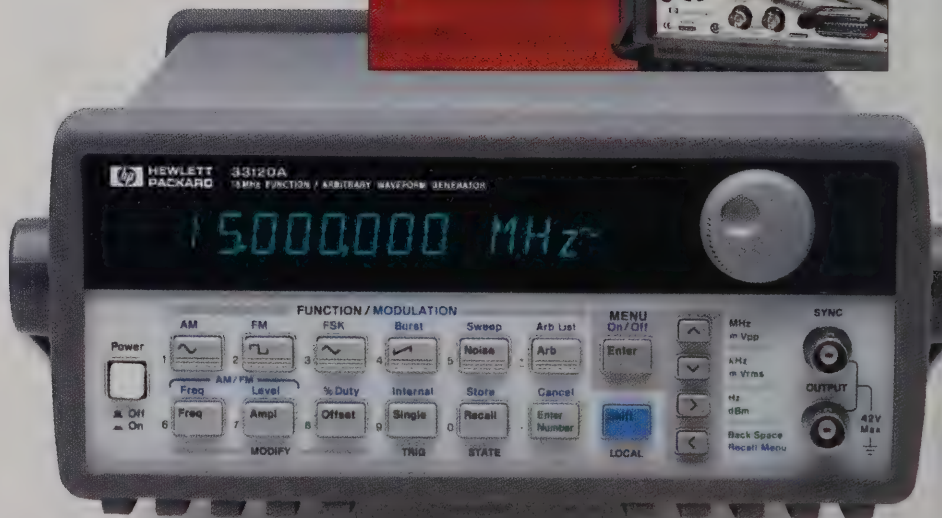
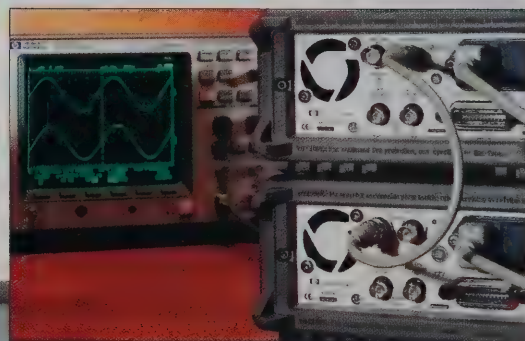


*Internal AM, FM, FSK, and burst modulation eliminate the need for a second modulation source.*



*Both linear and log sweeps are built in, making filter and amplifier testing quick and easy.*

*The Option 001 phase lock/TCXO timebase increases the HP 33120A's frequency stability and opens up new system options. Generate precise phase-offset signals, phase-lock two HP 33120As or sync your generator to a 10 MHz frequency standard. You can even tie an entire ATE system to a master clock.*





## HP 33120A Function/Arbitrary Waveform Generator

### Waveforms

Standard	Sine, square, triangle, ramp, noise, sin(x)/x exponential rise and fall, cardiac, dc volts		
Arbitrary			
Waveform length	8 to 16,000 points		
Nonvolatile memory	Four waveforms (each from 8 to 16,000 points)		
Amplitude resolution	12 bits		
Sample rate	40 MSa/s		

### Frequency characteristics

Sine	100 $\mu$ Hz–15 MHz	White noise	10 MHz bandwidth
Square	100 $\mu$ Hz–15 MHz	Resolution	10 $\mu$ Hz or 10 digits
Triangle	100 $\mu$ Hz–100 kHz	Accuracy	10 ppm in 90 days
Ramp	100 $\mu$ Hz–100 kHz		(18 °C–28 °C)

### Sinewave

Harmonic distortion	
dc to 20 kHz	–70 dBc
20 kHz to 100 kHz	–60 dBc
100 kHz to 1 MHz	–45 dBc
1 MHz to 15 MHz	–35 dBc
THD dc to 20 kHz	<0.04%

### Output characteristics

Amplitude	
(into 50 $\Omega$ )	50 mVp-p–10 Vp-p
(into open circuit)	100 mVp-p–20 Vp-p
Accuracy (at 1 kHz)	$\pm$ 1% of specified output
Flatness (sinewave relative to 1 kHz)	
<100 kHz	$\pm$ 1% (0.1 dB)
100 kHz to 1 MHz	$\pm$ 1.5% (0.15 dB)
1 MHz to 15 MHz	$\pm$ 2% (0.2 dB)

### Modulation

AM		FSK	
Carrier –3 dB Frequency	15 MHz (typical)	Internal Rate	10 mHz–50 kHz
Modulation	Any internal waveform including Arb	Deviation	10 mHz–15 MHz
Frequency	10 mHz–20 kHz	Source	Internal/external (1 MHz max.)
Depth	0%–120%	Burst	
Source	Internal/external	Carrier Frequency	5 MHz max.
FM		Count	1 to 50,000 cycles
Modulation	Any internal waveform including Arb	Start Phase	–360° to +360°
Frequency	10 mHz–10 kHz	Internal Rate	10 mHz–50 kHz $\pm$ 1%
Deviation	10 mHz–15 MHz	Gate Source	Internal/external gate
Source	Internal only	Trigger Source	Single, external or internal rate

### Option 001 Phase Lock/TCXO Timebase

Timebase accuracy	
Stability	$\pm$ 1 ppm 0 °C–50 °C
Aging	<2 ppm in first 30 days (continuous op)
	0.1 ppm/month (after first 30 days)

External reference/Input Lock range	10 MHz $\pm$ 50 Hz
-------------------------------------	--------------------

Internal reference/Output Frequency	10 MHz
-------------------------------------	--------

Power	100 V/120 V/220 V/240 V
-------	-------------------------

Net weight	4 kg (8.8 lbs)
------------	----------------

Size	254.4 mm W x 103.6 mm H x 374 mm D (10.0 x 4.0 x 15.1 in)
------	---

Warranty	3 years
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### Ordering information

HP 33120A Function/Arb generator	\$1,725.00 ea.	Opt. W50 Additional 2-year warranty	\$45.00 ea.
Opt. 001 Phase Lock/TCXO Timebase	395.00 ea.	Opt. 910 Extra manual set	36.00 ea.
Opt. 106 HP 34811A BenchLink Arb software	295.00 ea.	HP 34161A Accessory pouch	38.00 ea.
(can also be ordered separately as HP 34811A)		HP 34397A dc-to-ac inverter	160.00 ea.
Opt. 1CM Rack mount kit	52.00 ea.		

See page 33 for RS-232 and HP-IB cable needs.

# Manufactured to reduce cost — not capability.

When our engineers design low-cost products, manufacturing time is one of their top concerns. After all, money we squeeze out of the production process is money that stays in your pocket.

For the HP 33120A, specialists from R&D, production, and quality assurance started with the goal of creating a no-compromises product that could be manufactured quickly and efficiently. They finished with a function generator that we can assemble in less than one-third the time its predecessor took. The new design cuts test time in half, too.

Bob Langenburg  
AAS/BS

Southern Illinois University

Create waveforms on a PC and download them to the HP 33120A with HP 34811A BenchLink Arb software.  
(See pages 30–31.)



# Within budget, without compromise.

I've had a lot of experience with function generators. Give me a call.

# 1-800-452-4844

P A G E

23



# 225 MHz counters: first you save money, then you save time.

Universal and RF counters that give a lot more than they take.

The HP 53100-series provides exceptionally fast measurements, unflinching accuracy, and rugged, lightweight construction that fits as nicely within your budget as it does on your benchtop. Choose the model with the features you need, with frequencies up to 1.5, 3, or 5 GHz as options.

**No more waiting  
between measurements.**

The HP 53100-series uses real-time digital signal processing to analyze data while simultaneously taking new readings. So while other counters are stuck in processing "dead time," these HP counters have already moved on to the next measurement.

Not only faster, they're also easier to use.

With automated limit tests and one-button access to the features you need most, you'll get the job done in a hurry. And once you've set up for a test, a touch of

the Recall button will instantly restore that setup when you need it again.

It's easy to get more from your test data, too. You can perform statistics on all measurements and simultaneously measure and track average, min/max and standard deviation.

**Automation is fast  
and easy, too.**

With the HP-IB interface, standard command language (SCPI), and

continuous data transfer rates of over 200 measurements per second, you'll get the job done in a hurry.

**Fast. Accurate.  
Easy. For even  
MORE on  
these counters,  
call HP DIRECT.**

1-800-  
452-4844

Only \$1,725  
HP 53131A



A quick glance at the analog mode display tells you whether a measurement is within pass/fail limits.

An advanced method for measuring frequency and time intervals gathers more data with each measurement, so you get higher-resolution answers in a fraction of the time.

**Speed, function and economy:  
pick the model that's best for you.**

The HP 53131A offers 10 digit/sec resolution at up to 225 MHz on two channels (with an optional 3 or 5 GHz third channel), with a variety of measurements — from frequency, time interval, and pulse parameters to phase angle and totalize.

Need more performance? HP 53132A offers the same measurement set as the HP 53131A, with up to 12 digit/sec resolution — the highest measurement throughput and resolution available.

Need a counter optimized for RF applications? The value-priced HP 53181A RF counter provides 10 digits/second up to 225 MHz, with the option of a 1.5, 3, or 5 GHz second channel.



**HP 53132A** \$2,495

- Same features and functions as the HP 53131A
- Increased resolution — up to 12 digits/sec
- Even faster measurement rates for most signals



**HP 53181A** \$1,500

- Same speed, accuracy and resolution as HP 53131A at a budget price
- Same statistics, math, and automated limit testing
- Frequency, period, and peak voltage measurements
- Optional second channel provides 1.5, 3, or 5 GHz measurements





# HP 53131A, HP 53132A 225 MHz Universal Counters and HP 53181A 225 MHz RF Counter

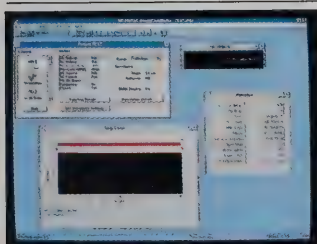
	HP 53131A	HP 53132A	HP 53181A
<b>Measurements</b>	Frequency, frequency ratio, time interval, period, rise/fall time, positive/negative pulse width, duty cycle, phase (CH 1 to CH 2), totalize, peak voltage, time interval average, time interval delay		Frequency, frequency ratio (with optional CH 2), period, peak voltage
<b>Analysis</b>	Automatic limit testing, math (scale and offset), statistics (minimum, maximum, mean, standard deviation). Statistics available on all measurements or only measurements that fall within limits.		
<b>Measurement characteristics</b>			
Frequency range	CH 1 & 2: dc–225 MHz	CH 1 & 2: dc–225 MHz	CH 1: dc–225 MHz
Frequency resolution	10 digits/sec	12 digits/sec	10 digits/sec
Measurement speed	Up to 200 meas/s	Up to 200 meas/s	Up to 200 meas/s
Time interval resolution (LSD)	500 ps	150 ps	NA
<b>Input conditioning</b>	(Independently selectable on CH 1 & 2)	(Independently selectable on CH 1 & 2)	(Selectable on CH 1)
Impedance, coupling	1 M $\Omega$ or 50 $\Omega$ , ac or dc	1 M $\Omega$ or 50 $\Omega$ , ac or dc	1 M $\Omega$ or 50 $\Omega$ , ac or dc
Low pass filter	100 kHz, switchable	100 kHz, switchable	100 kHz, switchable
Attenuation	$\times 1$ or $\times 10$	$\times 1$ or $\times 10$	$\times 1$ or $\times 10$
<b>External timebase reference input</b>	1, 5, 10 MHz	10 MHz	1, 5, 10 MHz
<b>Trigger</b>	CH 1 & 2 Trigger on rising/falling edge; set level by percent of signal level or absolute voltage; set sensitivity to LOW, MED, or HIGH	CH 1 & 2	CH 1
<b>Gating and arming</b>	Auto, manual (set gate time or number of digits of resolution); external; delay		
<b>Interfaces</b>	Standard HP-IB (IEEE 488.1 and 488.2) with SCPI-compatible language; talk only RS-232		
<b>Power</b>	90–132 Vac; 45–66 Hz or 360–440 Hz/198–264 Vac; 45–66 Hz		
<b>Net weight</b>	3 kg (6.5 lbs)		
<b>Size</b>	212.6 mm W x 88.5 mm H x 348.3 mm D (8.5 x 4.0 x 14.0 in)		
<b>Warranty</b>	3 years		

## Ordering information

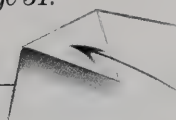
HP 53131A	10 digit per second 225 MHz Universal counter	\$1,725.00 ea.	Opt. 002	External dc power	\$250.00 ea.
HP 53132A	12 digit per second 225 MHz Universal counter	2,495.00 ea.	Opt. 010	High-stability timebase	900.00 ea.
HP 53181A	10 digit per second 225 MHz RF counter	1,500.00 ea.	Opt. 012	Ultra-stability timebase	1,500.00 ea.
	(counters include power cord, operating & programming manuals)		Opt. 015	1.5 GHz Channel 2 (HP 53181A only)	500.00 ea.
HP 34812A	BenchLink Meter	150.00 ea.	Opt. 030	3 GHz Channel 3 (3 GHz Channel 2 on HP 53181A)	800.00 ea.
Opt. W50	Additional 2-year warranty* starts at	45.00	Opt. 050	5 GHz Channel 3 with type-N connector (CH 2 on HP 53181A)	2,350.00 ea.
Opt. 001	Medium-stability timebase	600.00 ea.	HP 34397A	dc-to-ac inverter	160.00 ea.

Complete your test system with quality HP cables; see page 33.

\*Call HP DIRECT for more information on Opt. W50 prices.



Add value to your counter data!  
HP 34812A BenchLink Meter adds  
graphics, more statistics, and  
archiving. See page 31.



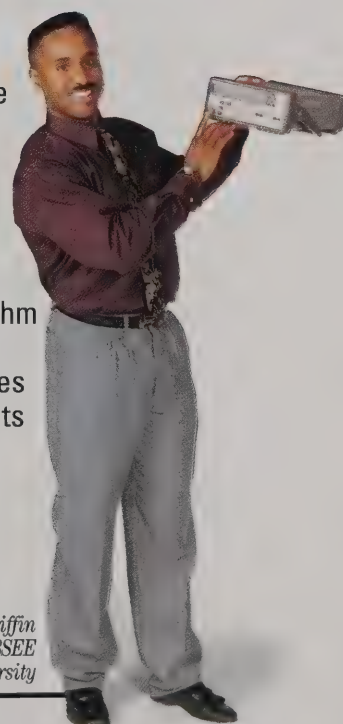
## Delivering innovative technology at an everyday price.

It would be just about impossible to create counters with this much performance at prices this low if you started from scratch. Fortunately, our engineers didn't have to. By leveraging innovative technology developed for HP's modulation domain analyzers

(MDAs), they gave these low-cost counters top-of-line performance.

For instance, it's the MDA's signal processing algorithm (programmed into the HP 53100-series gate array) that lets us offer up to 12 digit/second resolution in a value-priced counter.

Hardy Griffin  
BSEE  
Colorado State University

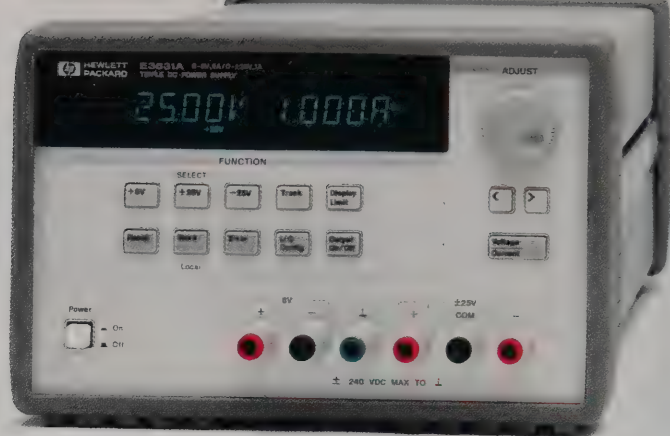


For the counter that best meets your measurement needs,  
call HP DIRECT.

# 1-800-452-4844



# Forget about "or." The key word here is "and."



**Programmability and 80 watts of power and triple outputs and 0.01% regulation.**

Tired of people asking you to choose, and then charging you for the privilege? Now you can take it all with the new HP E3631A triple output dc power supply — and pay a lot less than you'd pay for some of those other supplies.

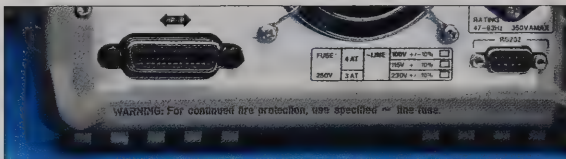
## Flexible at both ends.

Run the HP E3631A as a stand-alone bench supply, and you'll have precise power with flat 0.01% load and line regulation. Set exact output levels quickly and verify your settings with the dual voltage and current meters. The 6-volt supply is completely isolated from the two 25-volt supplies, which you can track together, operate independently or use as a single 50-volt supply.

Connect the HP E3631A to a PC or other controller via the built-in HP-IB or RS-232 port, and you'll have an automated source to power up boards, characterize devices, and simultaneously power and bias active components. Standard Commands for Programmable Instruments (SCPI) means it's simple to program, too.

## Built for the long haul.

Like all HP supplies, the HP E3631A will be powering your projects for a long time to come. (We back up this bit of boasting with a three-year warranty.)



Programmability is standard with both HP-IB and RS-232.

Only \$995

HP E3631A Triple Output DC Power Supply		1	2	3
<b>DC outputs</b>				
Voltage		0 to +25 V	0 to -25 V	0 to 6 V
Current		0 to 1 A	0 to 1 A	0 to 5 A
<b>Load and line regulation</b>				
Voltage		<0.01% + 2 mV		
Current		<0.01% + 250 μA		
<b>Ripple and noise</b>				
Normal mode voltage		<350 μVrms/2 mVp-p		
Normal mode current		<500 μArms	<500 μArms	<2 mArms
Common mode current		<1 μArms		
<b>Programming accuracy</b>				
Voltage		0.05% + 10 mV		0.1% + 5 mV
Current		0.15% + 4 mA		0.2% + 10 mA
<b>Readback/meter accuracy</b>				
Voltage		0.5% + 10 mV		0.1% + 5 mV
Current		0.15% + 4 mA		0.2% + 10 mA
<b>Resolution</b>				
Program/readback		1.5 mV/0.1 mA		0.5 mV/0.5 mA
Meter		10 mV/1 mA		1 mV/1 mA
<b>Transient response</b>		50 μsec for output to recover to within 15 mV following a change in output current from full load to half load or vice versa		
<b>Supplemental Characteristics</b>				
<b>Command processing time</b>			<100 msec	
<b>Voltage programming speed to within 0.1% of final value</b>		<u>Full load</u>	<u>No load</u>	<u>Full load</u> <u>No load</u>
Up		50 msec	20 msec	11 msec   10 msec
Down		45 msec	400 msec	13 msec   200 msec
<b>Isolation</b>			±240 Vdc	
<b>Size</b>		132 mm H x 213 mm W x 360 mm D (5.2 x 8.4 x 14.2 in)		
<b>Weight</b>		8.2 kg (18 lbs)		
<b>Warranty</b>		3 years		
<b>Price (U.S. list)</b>		\$995		

Put it all on your bench.

**1-800-452-4844**



# These multiple output power supplies fit your budget as well as your benchtop.

Only \$500

## Built like system supplies, but priced for the bench.

The ordinary way to create a low-cost power supply is to offer fewer features and lower performance. Trouble is, you don't want an ordinary supply. Maybe it's time to put an HP on your bench. Only HP offers a supply packed with valuable features at the same high quality you expect from our system supplies.

With multiple outputs, there's no need to fill your benchtop — or empty your budget — with more than one supply. (The outputs on the HP E3620A are completely independent and isolated.)

## You won't have to compensate for unwanted signals.

Find some peace and quiet. The peace of mind that comes from tight 0.01% load and line regulation. The quiet that comes from ripple and noise levels at  $<350 \mu\text{Vrms}/1.5 \text{ mVp-p}$  with minimal line current injection.

For clean power you've never expected from a benchtop power supply.

1-800-  
452-4844

## Protect your circuitry and your investment with the two-output HP E3620A and the three-output HP E3630A.

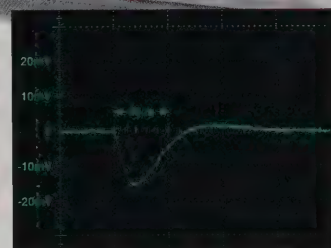
Smooth turn-on and turn-off transitions keep power spikes out of your circuits. The HP E3620A and HP E3630A give you stable performance from start to finish.

These low-cost supplies undergo the same rigorous tests as our system supplies. The result? A failure rate of less than 0.5% per year backed by a three-year warranty. Find that in another low-cost supply!

## Make output settings quickly with an easy-to-use front panel.

Save time while you're saving money. Because separate meters display voltage and current, you can set levels precisely and monitor each output at a glance. In other words, you can focus on your circuits and test procedures instead of fiddling with your power supply.

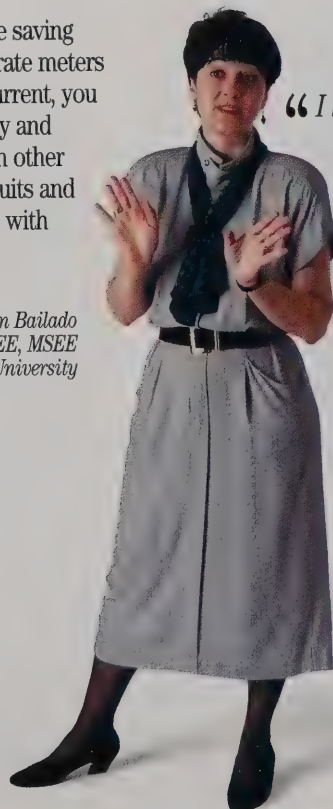
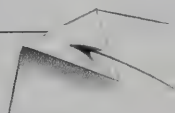
Helen Bailado  
BSEE, MSEE  
Santa Clara University



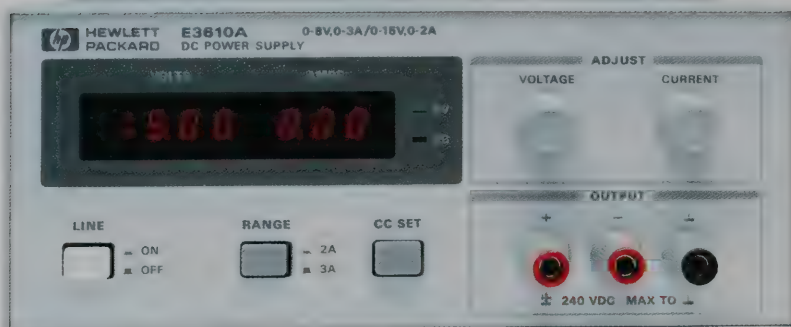
Fast transient response means stable and predictable voltages for your circuitry when the load varies.

*“I know you want to choose the right power supply, and you don't want to wait forever. Give me a call, and we can go over specs and features.”*

See next page for HP E3620A and HP E3630A specs and more of HP's low-cost, high-value power supplies!







Starting at  
only \$300

# The only thing we left out of these power supplies was the high price.

## Put the performance of a system power supply on your benchtop.

Forget the usual worries about low-cost supplies. The HP E3600-series gives you clean power with dependable regulation and fast transient response. And they turn on and off without overshoot, so you get precise output from start to finish.

The pleasant surprises don't stop there. You can choose constant voltage (CV) mode or constant current (CC) mode, changing automatically based on load. In CV mode, it's easy to set safe current levels for every test.

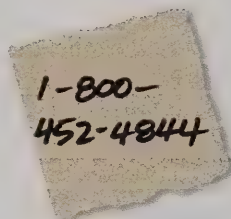
## We spent a lot of time on our front panel so you won't have to.

Tired of fumbling with confusing dials and buttons? A pair of digital meters shows your output status at a glance, and the 10-turn pots are quick and accurate.

## Inferior supplies cause more than employee burnout.

Whose side is your power supply on, anyway? A poorly regulated supply that puts your circuits in danger is working against you, not for you. In the

Get clean power  
with any supply  
you select.



HP E3610/11/12A, CV/CC mode lets you preset both current and voltage limits so you can be sure your circuits are getting the levels you think they are.

For even more peace of mind, check out the HP E3614/15/16/17A. Adjustable overvoltage protection — a feature you don't expect on low-cost supplies — makes it easy to keep your circuits out of

harm's way. One switch is all you need to set precise voltage and current limits.

Supplies that sense voltage levels at their outputs may not be as accurate as you need. The HP E3614/15/16/17A use remote sensing to measure voltage at the load instead. Count on unsurpassed

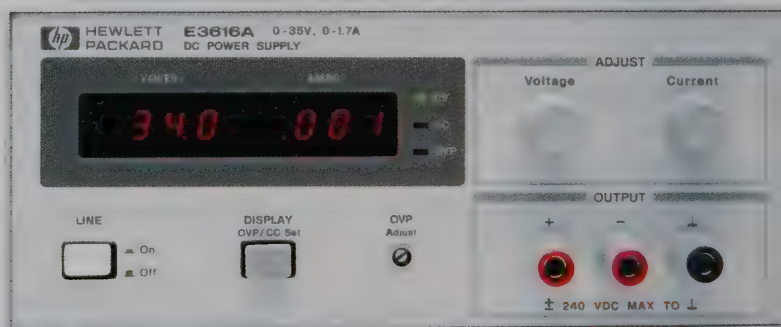
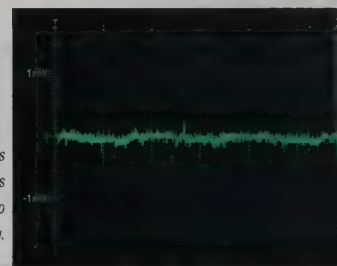
accuracy during your tests — the supply automatically compensates for voltage drops.

So stop worrying about circuit damage from poorly regulated supplies. In fact, you don't need to worry about your supply at all. With a failure rate under 0.5% per year and a three-year warranty, there's nothing left to worry about.

## Control multiple supplies from one master unit.

Need more current or voltage? The HP E3614/15/16/17A let you control multiple supplies with a single unit. Autoparallel shares current equally, and autoseries shares voltage equally or proportionally. And when you're tied in series, autotracking lets you change levels simultaneously or proportionately.

*Low noise means  
unwanted signals  
aren't injected into  
your circuitry.*





# HP E3600-series dc Power Supplies

	HP E3610A	HP E3611A	HP E3612A	HP E3614A	HP E3615A	HP E3616A	HP E3617A	HP E3620A	HP E3630A
Number of outputs	1	1	1	1	1	1	1	2	3
Output (max. voltage, current)	8 V, 3 A or 15 V, 2 A	20 V, 1.5 A or 35 V, 0.85 A	60 V, 0.5 A or 120 V, 0.25 A	8 V, 6 A	20 V, 3 A	35 V, 1.7 A	60 V, 1 A	25 V, 1 A 25 V, 1 A	+6 V, 2.5 A +20 V, 0.5 A -20 V, 0.5 A
Features	Dual range, 10-turn pots, Constant Voltage (CV), Constant Current (CC) modes			Adjustable overvoltage protection, voltage programming, remote sense, rear outputs, 10-turn pots, CV, CC modes; multiple supplies can be connected for tracking or higher power			Dual outputs, 10-turn pots, CV, CL		Tracking, CV, CL
Load and line regulation	0.01% + 2 mV								
Ripple and noise voltage	<200 $\mu$ Vrms, <2 mVp-p			<200 $\mu$ Vrms, <1 mVp-p				<350 $\mu$ Vrms, <1.5 mVp-p	
Common mode current	Not specified							<1 $\mu$ Arms	
Transient response time	<50 $\mu$ sec following change in output current from full load to half load for output to recover to within: 10 mV			15 mV					
Meter accuracy	$\pm 0.5\% + 2$ counts at 25 °C $\pm 5$ °C								
Meter resolution	voltage	10 mV	100 mV	10 mV	10 mV (0–20 V), 100 mV (>20 V)				10 mV
	current	10 mA	1 mA	10 mA			1 mA	10 mA	
Isolation	240 Vdc								
Size	91 mm H x 213 mm W x 319 mm D (3.6 x 8.4 x 12.6 in)			91 mm H x 213 mm W x 400 mm D (3.6 x 8.4 x 15.8 in)					Same as HP E3610A
Warranty	3 years								
Price	\$300.00 ea.			\$500.00 ea.					
Options	Opt. 0E9 100 Vac $\pm 10\%$ , Opt. 0E3 230 Vac $\pm 10\%$ , Opt. W50 Additional 2-year warranty \$45.00 ea.								

## How do you build more accuracy AND less cost into a power supply?

The secret is experience. Our power products engineers have years of experience designing everything from top-of-the-line system supplies to value-priced benchtop units. For the HP E3600-series, they used that experience to make sure these new supplies provide stable, dependable output signals.

Just as important, however, is our experience in manufacturing. Because our production specialists have built so many supplies over the years, they

know how to cut costs without cutting corners.

Improvements such as standardized parts for more efficient inventory management and redesigned cases with fewer screws that take less time to assemble. They seem like little things, but they add up to big savings.

So put some experience on your benchtop, with products that fit your budget without compromising performance.



Within budget,  
without compromise.

Call HP DIRECT to discuss the power supply that's right for you.

**1-800-452-4844**

PAGE

29



# Capture it, display it, document it with HP BenchLink connectivity solutions.

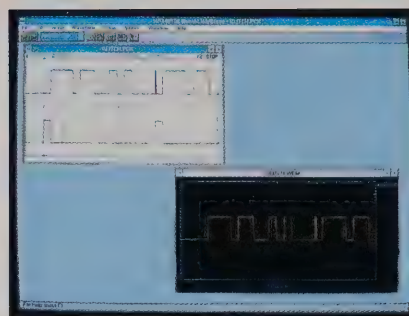
Is communicating measurement results a major part of your job? Analyzing results, documenting your work, reporting to management — the need to get more from your data never ends.

The HP BenchLink family of PC connectivity solutions makes these tasks easier. You can gather instrument data quickly and use it more effectively, and we've done all the programming for you.

## ***HP BenchLink Scope***

**Time to throw out the scissors and tape.**

With HP BenchLink Scope, it's easy to transfer screen images from an HP 54500- or HP 54600-series scope (or the HP 54620A logic analyzer) to your PC. From there, the Windows Clipboard makes it a snap to create polished reports or presentations by moving scope results into your Windows applications with a click of the mouse. And for archiving, just store the images



*With HP BenchLink Scope, move data and screen images to your PC and use them in any Windows-based application.*

on disk in either PCX or TIFF formats — with time and date stamps, too.

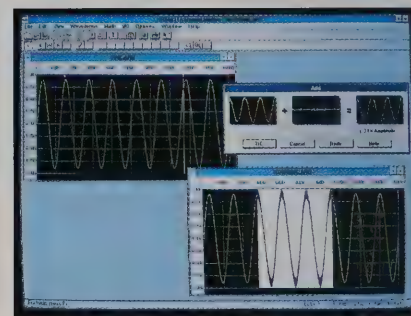
**Extract more information from your data.**

In addition to screen images, HP BenchLink Scope lets you transfer the actual waveform data (stored as time/voltage pairs) for analysis in spreadsheets or statistical packages. You can also use scope waveforms as input for arbitrary waveform generation by teaming up with HP BenchLink Arb.

## ***HP BenchLink Arb***

**Creating waveforms is now as easy as drawing a picture.**

HP BenchLink Arb turns the HP 33120A function/arb generator into a "design studio" for arbitrary waveforms. You can create, edit and download waveforms with the graphical ease Windows has to offer. The drawing palette lets you draw

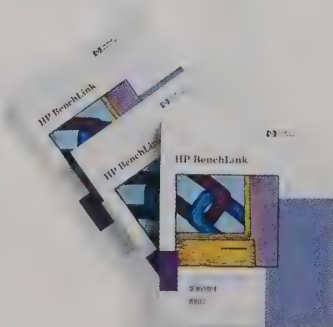


*HP BenchLink Arb allows you to create your own waveforms and download them to your generator — with Windows ease.*

any shape you can imagine and add noise, pulses, and sine, square, or triangle waves. (No, you don't have to be an artist!)

**Creating and editing are easy; just choose the method that works best for you.**

- Use the drawing tools and standard waveform library to create any waveform your application requires.
- Edit and replay waveforms captured with HP BenchLink Scope.
- Import time and voltage data in ASCII files. (Imagine this: create a waveform algorithmically in a spreadsheet or math/statistics package, then sit back and watch the HP 33120A generate it as a live signal!)



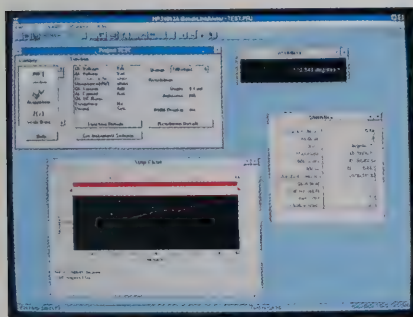
Starting at \$150



## HP BenchLink Meter

Turn your DMM into a data collection system.

Precision and flexibility are a powerful combination. You'll get precision data from the HP 34401A digital multimeter or the HP 53100-series counters and flexibility from HP BenchLink Meter and Windows. With the instrument data on your PC, you can create graphs, move



HP BenchLink Meter adds a new visual dimension to your DMM or counter data, making it easy to graph, tabulate and store results.

test results into a variety of Windows applications, catalog test results, and perform basic statistical analysis — without writing a single line of code.

### Increase the value of your DMM or counter.

When it's easy to gather test data and easy to get more information from your data, your test results become more valuable. Especially when you can use the HP multimeter or counter that you already own.

HP BenchLink Meter's ability to configure and run tests from the PC makes data gathering a breeze. It's easy to follow and evaluate incoming data with the strip chart display and limit test features. Plus, you'll discover how quick and simple trending and data comparison become with the statistics and archiving tools. All of which means you've increased the value of your instruments — and your time.

## HP BenchLink Suite

If you like the idea of using HP BenchLink Scope and HP BenchLink Arb together, or if you just think you'll need more than one HP BenchLink application, we've bundled all three products in the bargain-priced HP BenchLink Suite.

## Products that fit the way you'd really like to work.

Does this sound familiar? You need to modify a circuit, but you don't want to pull out your soldering iron before you know you have the right solution. With HP BenchLink Arb to replay waveforms captured with HP BenchLink Scope, it's easy to perform "what if" analysis without making actual circuit changes. Capture a live signal, mix in some noise, then use the HP 33120A to inject the new test signal back into your circuit. You can test the design change before you do anything drastic. This is just one of the many powerful things you can do with HP BenchLink.

To make things as easy as possible, the HP BenchLink series runs on any 386 or better PC with Microsoft Windows 3.1 or later, with either the RS-232 or HP-IB interfaces (both HP and National Instruments IEEE-488 cards are supported).

### HP BenchLink

#### Ordering information

##### Requirements

- 386 or 486 AT-compatible computer
- Serial port (COM 1, 2, 3, or 4), or IEEE-488 card (HP 82335A/B, HP 82340A, HP 82341A/B, or National Instruments AT-GPIB, AT/TNT, or GPIB-PC)
- 4 MB or more RAM

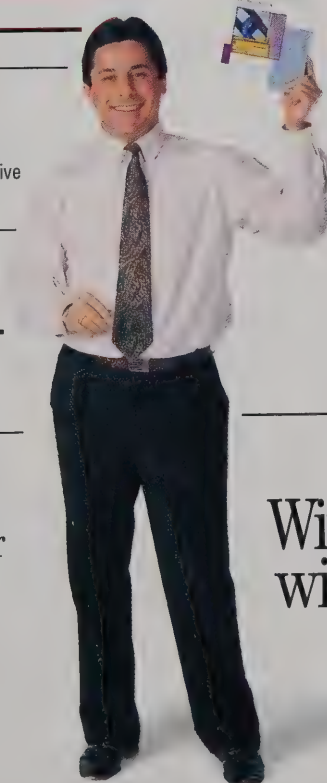
- MS-DOS 4.01 or later
- Windows 3.1 or later
- MS-compatible mouse
- 3.5" high-density floppy drive
- 2 MB disk space for each application

HP 34810A BenchLink Scope	\$295.00 ea.
HP 34811A BenchLink Arb	295.00 ea.
HP 34812A BenchLink Meter	150.00 ea.
HP 34820A BenchLink Suite*	395.00 ea.

Each HP BenchLink package includes a 3.5" disk and user's guide.

\*This software suite includes HP BenchLink Scope, Arb and Meter.

Microsoft Windows is a U.S. trademark and MS-DOS is a registered trademark of Microsoft Corporation.



We can answer any questions about computer requirements, data compatibility, or HP-IB interface cards.

# 1-800-452-4844

## Within budget, without compromise.



# Automation as fast as it is affordable.

Add world-class test automation for as little as **\$395** — including Windows software!

## Put big-league automation on your benchtop.

Test engineers have been relying on HP-IB (IEEE-488) for years, and now you can have it with the ease and simplicity of Windows. Control instruments, transfer results, and use PC software to analyze your data — at a price you probably didn't think was possible.

## Pick the optimum level of performance.

The high-speed HP 82341C provides built-in buffering for fast I/O, making it perfect for demanding applications and multi-instrument systems. The mid-range HP 82340B is ideal for single-task applications with a dedicated PC. And

the versatile HP 82335B is the right answer for DOS setups, particularly where you want compatibility with existing programs.

## Pull it together with test automation software.

The I/O libraries included with the HP 82340B and the HP 82341C contain HP's Standard Instrument Control Library (SICL) and HP's VTL 3.0. VTL 3.0 is the I/O library specified by the *VXIplug&play* Alliance, of which HP is a leading member. The HP Command Library, included with the HP 82335B, supports both DOS and Windows operation.



*You can control any HP-IB instrument from your Windows application.*



*Efficiently develop test programs for most programming languages right from your PC.*

HP 82335B HP-IB Card, HP 82340A HP-IB Card, and HP 82341A High-performance HP-IB Card

	HP 82335B	HP 82340B	HP 82341C		
Operating system	DOS, Windows 3.1	Windows 3.1, Windows NT, Windows 95	Windows 3.1, Windows NT, Windows 95		
I/O Library*	Command Library	Standard Instrument Control Library and VTL 3.0	Standard Instrument Control Library and VTL 3.0		
Languages	C, Pascal, BASIC incl. Visual Basic	C/C++, Visual Basic, HP VEE	C/C++, Visual Basic, HP VEE		
Backplane**	ISA/EISA (8 bit)	ISA/EISA (8 bit)	ISA/EISA (16 bit)		
Max. I/O speed	355 KB/sec	520 KB/sec	750 KB/sec		
Optional buffering	No	No	Yes		
Warranty	1 year	1 year	1 year		
Ordering information					
HP 82335B	HP-IB card for Windows and DOS	\$445.00 ea.	HP 82341C	High-performance HP-IB card for Windows	\$495.00 ea.
HP 82340B	HP-IB card and SICL for Windows 3.1, Windows NT, and Windows 95	395.00 ea.			

\*Applications written using the HP 82335B Command Library software will not run on the HP 82340B or HP 82341C.

\*\*One ISA/EISA slot required.

Microsoft Windows is a U.S. trademark and MS-DOS is a registered trademark of Microsoft Corporation.



# We're here to help you succeed with HP-IB.

Nobody's been doing HP-IB longer than the people who invented it, so you can count on HP for practical, productive solutions.

Start with the hardware. You won't find any other standard interfaces for test automation that are this affordable or this easy to install.

Next, the software libraries bundled with these cards give you a head start on instrument control, I/O, controller communications, and the other program functions you'll need.

And if you need help, the HP PC T&M Helpline has experts standing by the phone.

HP-IB from the experts at HP: it's the difference between selling you a collection of parts and making sure you have a complete solution.

Lady Oak Arnold  
BSEE  
Seattle University

## High-quality HP cables with just one phone call.

### HP-IB Cables

Product No.	Description	Length	Price
HP 10833A	HP-IB cable	1 m (3.3 ft)	\$90.00 ea.
HP 10833B	HP-IB cable	2 m (6.6 ft)	100.00 ea.
HP 10833C	HP-IB cable	4 m (13.2 ft)	110.00 ea.
HP 10833D	HP-IB cable	0.5 m (1.6 ft)	90.00 ea.
HP 10834A	HP-IB to HP-IB adapter	*	35.00 ea.

\*Provides additional clearance between HP-IB cable and rear panel of instrument.

### HP 50 $\Omega$ Coaxial Cables

Part No.	Description	Length	Price
8120-1838	2 BNC (m) connectors	30 cm	\$19.50 ea.
8120-1839	2 BNC (m) connectors	61 cm	20.00 ea.
8120-1840	2 BNC (m) connectors	122 cm	23.50 ea.
11000-60001	Dual banana plugs	112 cm	30.00 ea.
11001-60001	One UG-88 C/U BNC (m) conn. and one dual banana plug	112 cm	30.00 ea.

### HP RS-232 Cables

Product No.	Description	Length	Price
HP 34398A	9 pin (f) to 9 pin (f) plus 9 pin (m) to 25 pin (f) adapter	2.5 m (8.2 ft)	\$20.00 ea.
HP 24542G	25 pin (m) to 9 pin (f)	3 m (9.8 ft)	45.00 ea.
HP C2913A	25 pin (m) to 25 pin (f)	1.2 m (3.9 ft)	18.00 ea.
HP C2914A	25 pin (m) to 25 pin (m)	1.2 m (3.9 ft)	18.00 ea.
HP 34399A	Adapter kit (contains 4 adapters): 9 pin (m) to 25 pin (m) for use with PC or printer 9 pin (m) to 25 pin (f) for use with PC or printer 9 pin (m) to 25 pin (m) for use with modem 9 pin (m) to 9 pin (m) for use with modem		26.00 ea.

### HP RS-232 Selection Guide for Basic Instruments\*

Instrument	PC or Printer Connector		
	25 pin male	25 pin female	9 pin male
HP 54600-series with HP 54652B/59B <sup>1</sup> , HP 34401A <sup>1</sup> , HP 33120A <sup>1</sup>	HP 34398A	HP 34398A + HP 34399A	HP 34398A
HP 53131/32/81A <sup>2</sup>	HP 34398A	HP 34398A + HP 34399A	HP 34398A
HP 54600-series with HP 54651A/58A <sup>3</sup> ; HP 54656A <sup>4</sup>	HP C2913A	HP C2914A	HP 24542G

<sup>1</sup>Instrument connector is 9 pin (m).

<sup>2</sup>Instrument connector is 9 pin (m) and is a talk port only.

<sup>3</sup>Instrument connector on module is 25 pin (f).

<sup>4</sup>Instrument connector on module is 9 pin (f). Must use included 9 pin (m) to 25 pin (f) adapter.

\*This table recommends the compatible RS-232 cable to use when connecting basic instruments in this catalog to a PC or printer.

HP-IB and all the cables you need. Call now.

# 1-800-452-4844

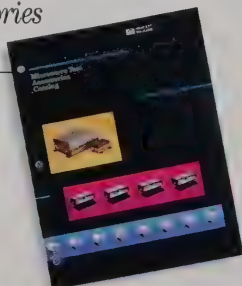


## RF Products

If your test needs extend into the RF range, you can keep looking to HP for instruments that get the job done right. And just like the Basic Instruments line, these RF products deliver the capabilities you need without capsizing your budget.

Here's a quick look at three of our most popular RF tools. The engineers at HP DIRECT can provide all the details on these products and help you select other tools to round out your RF bench — including power meters, LCR meters, and counters, too.

To complete your RF and microwave test bench, ask for a copy of HP's Microwave Test Accessories Catalog.



\$8,900

## HP 8590L Portable Spectrum Analyzer

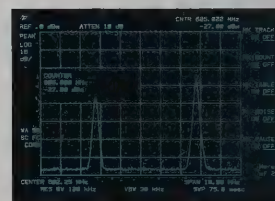
Do you appreciate quality but don't think you can afford it? Want a rugged, lightweight spectrum analyzer *and* lab-quality measurements? Frequency accuracy *and* low cost? Ease of use *and* dozens of measurement functions?

Well, you're in luck. The new HP 8590L portable spectrum analyzer delivers all that capability at a price that fits just about every budget.

The HP 8590L starts with solid measurement capability, including a frequency counter with accuracy of  $\pm 7.6$  kHz at 1 GHz. Then it adds numerous functions that deliver the answers you need day after day, including third-order intercept, adjacent channel power, limit lines, and marker tables that list multiple points on a trace.

Plus, the HP 8590L works hard to boost your personal productivity, from the logical front panel to the optional application personalities that give you quick access to specific test setups.

With frequency accuracy of  $\pm 7.6$  kHz at 1 GHz, you can pinpoint RF signals with confidence.



### HP 8590L

- Frequency accuracy in a low-cost analyzer
- Rugged & portable (only 14.5 kg)
- Easy to use in the lab or in the field
- Numerous built-in measurements, including adjacent channel power
- Optional internal tracking generator to test components

#### HP 8590L Performance Highlights (see data sheet for details)

##### Frequency

Range	9 kHz to 1.8 GHz
Accuracy	$\pm 7.6$ kHz at 1 GHz ( $\pm 2.1$ kHz excluding temperature drift)
Resolution bandwidths	1 kHz to 3 MHz (10 total)
Noise sidebands	$\leq 105$ dBc/Hz at 30 kHz offset

##### Amplitude

Range	-115 dBm to +30 dBm
Accuracy	$\pm 1.7$ dB (relative frequency response + IF gain accuracy)
Dynamic range (2nd/3rd order)	70 dB/80 dB
Gain compression	$-10$ dBm ( $>10$ MHz)



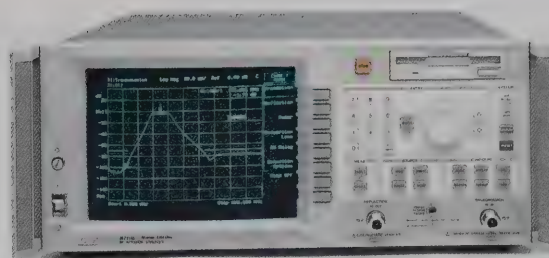
Starting at \$9,500

## HP 8711B Economy Network Analyzers

The HP 8711B network analyzers provide a complete device test solution from cable TV bench test to cellular radio. They deliver production-line test speeds without sacrificing accuracy. Repetitive testing is fast and easy with the integrated transmission/reflection test set, display

markers, limit lines and optional multi-port test sets and Instrument BASIC. With 100 dB dynamic range, broadband detection, 1 Hz resolution and 40 dB corrected directivity, you'll get results you can count on, too.

*Built-in limit testing is just one of the ways the HP 8711B boosts production throughput.*



### HP 8711B

- Choose scalar or vector measurements from 300 kHz to 3.0 GHz
- Ideal for testing RF components in cable, broadcast or cellular radio systems
- Rugged design and one-button automation ideal for field service, too

#### HP 8711B Performance Highlights (see data sheet for details)

Frequency range	300 kHz to 1.3 GHz (HP 8711B/12B) 300 kHz to 3.0 GHz (HP 8713B/14B)
Measurement type	Scalar (HP 8711B/12B) Vector (HP 8713B/14B)
Frequency resolution	1 Hz
Dynamic range	>100 dB (narrowband) >60 dB (broadband)
Directivity	40 dB

Starting at \$5,865

## HP 8648A/B/C Economy RF Signal Generator

Count on the HP 8648 family of RF signal generators to provide clean, dependable signals up to 3.2 GHz. With the addition of a one-hand remote controller, the simple-to-use semi-automated interface will reduce test times, too.

### HP 8648A/B/C

- Ideal for in-channel receiver tests
- FM, AM and PM
- Optional pulse and high power (HP 8648B/C)
- Superior output-level accuracy

#### HP 8648A/B/C Performance Highlights (see data sheet for details)

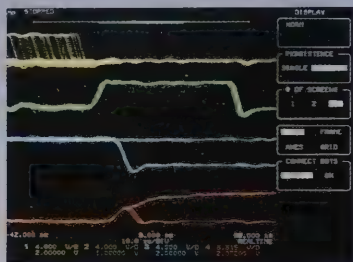
Frequency range	100 kHz to 3.2 GHz (HP 8648C) 100 kHz to 2.0 GHz (HP 8648B) 100 kHz to 1.0 GHz (HP 8648A) 250 kHz to 1.0 GHz (HP 8647A)
Output level	-136 dBm to +10 dBm (up to +20 dBm ≤2.5 GHz)
Level accuracy	±1 dB down to -127 dBm (≤2.5 GHz)
Spectral purity at 500 MHz SSB phase noise	-120 dBc/Hz (at 20 kHz offset typical)
Residual FM	<4 Hz (249 to 501 MHz) <7 Hz (<249 MHz, ≥501 MHz)

Call HP DIRECT today. **1-800-452-4844**

PAGE  
35



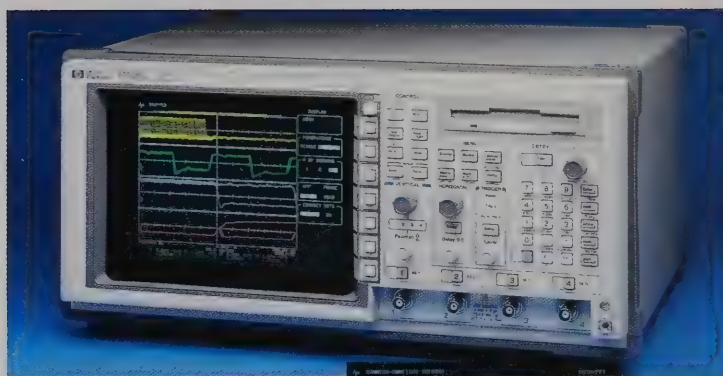
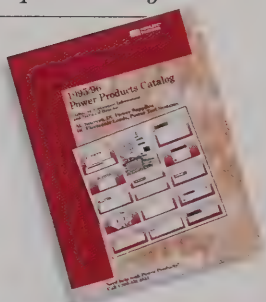
# Extra Performance



Chances are the Basic Instruments line covers most of your test and measurement demands. When you need an extra level of performance, however, check out this line. These instruments deliver the quality and capability that made HP's reputation in the industry — and they're now designed with the same emphasis on customer value you see in our Basic Instruments.

The HP 54520/40-series scopes, the HP 3458A multimeter, and the HP 8110A pulse generator are just three examples of the products we offer.

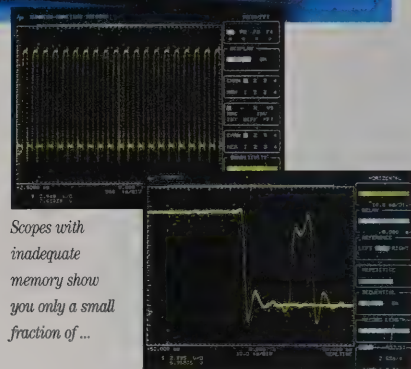
Ask for a copy of the HP Power Products Catalog to find all of HP's ac sources, dc power supplies, electronic loads and power test systems.



## HP 54520/40-series scopes

Is your scope telling you the whole story? If it's short on speed or memory, you're not going to get a complete and accurate view of the signals in your high-speed designs.

With 32K memory per channel, the HP 54520/40-series scopes let you maintain higher resolution over longer periods of time. And when you're armed with two or four channels running at up to 2 GSa/s (and 1 ns peak detect), you can catch hard-to-find problems before they catch you.



Scopes with inadequate memory show you only a small fraction of ...

...what you'll see with the HP 54520/40-series.

### HP 54520/40-series scopes

- Wide array of measurement and testing functions, from FFT to templates for pass/fail testing
- Choose two or four channels
- 500 MHz repetitive bandwidth on all models
- Single-shot bandwidths from 125 MHz to 500 MHz
- Sequential single-shot mode captures and time-tags successive pulses separated by long dead times

Starting at  
**\$9,500**

#### HP 54520/40-series Performance Highlights (see data sheet for details)

Maximum sample rate	from 500 MSa/s to 2 GSa/s
Repetitive bandwidth	500 MHz
Single-shot bandwidth	from 125 MHz to 500 MHz
Peak detect	≥1 ns
Vertical sensitivity	1 mV/div to 5 V/div
Timebase range	500 ps/div to 5 s/div
Horizontal resolution	10 ps
Memory depth	32K per channel



And how about a new scope that's fast enough to show all the details in your important signals — a look in the special brochure between pages 4 and 5 is the first step to seeing things you've never seen before.



How many glitches  
and fast edges is your  
scope missing?

Find some answers  
in the special insert  
brochure between  
pages 4 and 5.



Data subject to change.

Printed in U.S.A.

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5963-7228EUS



# HP 3458A multimeter

\$6,730

When you can't compromise on either resolution or throughput, the HP 3458A multimeter delivers 8½ digits of resolution and rates of up to 100,000 readings per second. And if you need to measure low-level signals with confidence, ask about the new HP 34420A nanovolt/micro-ohm meter and its 100 pV/100 µΩ sensitivity.



## HP 3458A

- dc volts from 10 nV to 1000 V
- Choice of analog or sampling true-rms ac volt techniques
- Resistance from 10 µΩ to 1 GΩ, two- and four-wire ohms, with OCOMP
- Math and statistical functions
- 20 KB of reading memory (148 KB optional)
- Self-adjusting autocalibration for all functions
- Two-source (10 V, 100 kΩ) calibration

## HP 3458A Performance Highlights (see data sheet for details)

<b>Calibration</b>	8½ digits resolution
<b>Lab precision</b>	0.1 ppm Vdc linearity 0.1 ppm Vdc transfer accuracy 8 ppm basic 1-year Vdc accuracy (4 ppm opt.) 100 ppm mid-band Vac
<b>Test system</b>	Up to 100,000 rdgs/sec
<b>Throughput</b>	340 function/range changes/sec
<b>High-resolution digitizing</b>	16 to 24 bits resolution Timing resolution to 10 ns



The ability to simulate real-world digital signals with precise edge positioning make the HP 8110A the ideal companion for your scope or logic analyzer. Signal-creation tools let you set up such key test signals as irregular pulse widths, pulse droop, groundbounce and multi-level waveforms.

## HP 8110A

- Ideal for digital design
- Master/slave capabilities for multi-channel tests
- Variety of signal modes, including bursts and patterns
- Modular design lets you add the functions you need

# HP 8110A 150 MHz pulse generator

Starting at  
\$10,200

## HP 8110A Performance Highlights (see data sheet for details)

<b>Frequency</b>	1.00 Hz to 150 MHz
<b>Resolution</b>	3 digits (10 ps best case)
<b>Output level</b>	up to 20 V
<b>Transition time</b>	2.5 ns, typical
<b>Burst length</b>	2 to 65,536 pulses or double pulses
<b>Patterns</b>	2 to 4,096 bits

Call HP DIRECT **1-800-452-4844**

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37



# Free catalogs for HP test and measurement products.



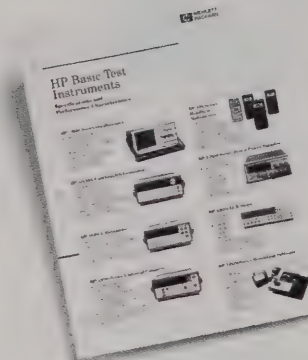
**The complete guide to all HP test and measurement products.**

The 1995 Test & Measurement Catalog (HP pub. #5962-0220EUS) contains information on all HP analyzers, sources, communication test equipment, and systems products (including VXIbus systems, board test, semiconductor test, and system controllers). In addition to product data, you'll find information about customer service, financing, leasing and rental.



Get updated product and service info from **Access HP**, our comprehensive

CommerceNet and World Wide Web site on the Internet. You can also order catalogs and application notes, as well as get current information on seminars and training classes. The address is <http://www.hp.com>.



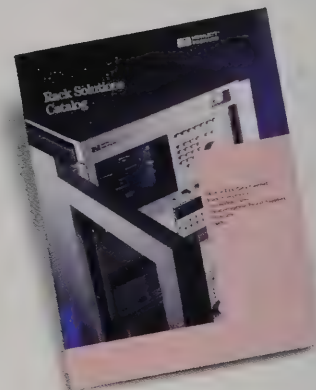
**Detailed specs and performance data for most basic instrument products.**

Get complete specifications on the HP 54600-series scopes, HP 33120A function/arb generator, HP 34401A digital multimeter, HP 53131A and HP 53132A universal counters, HP 970-series handheld multimeters, HP E3600-series power supplies, HP 54620A logic analyzer, and HP 34800-series BenchLink software.

Ask for HP publication numbers:

- 54600-series 5964-0382EUS
- 33120A 5964-0146EUS
- 34401A 5964-0145EUS
- 53100-series 5964-0385EUS
- 970-series 5964-0384EUS
- E3600-series 5964-0383EUS
- 54620A 5963-3565EUS
- BenchLink 5963-1860EUS (product numbers HP 34810A, HP 34811A, HP 34812A)

We can also provide a technical data sheet on any other HP products in this catalog.



**Organize your instrumentation with an HP rack system.**

The Rack Solutions Catalog (HP pub. #5963-1052EUS) highlights all the racks, adapters and accessories you need to build an efficient test and measurement system. You'll find information on 19-inch EIA racks, HP Testmobile carts, cables and accessories, uninterruptable power supplies, and furniture. The catalog also describes HP's system integration services and provides helpful guidelines for configuring rack systems.

These catalogs are just a phone call away.  
Call any one of our sales consultants and we'll send your information today.

## 1-800-452-4844





# Ordering Information

## Ordering

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### Where and when to call

Call 1-800-829-4444 any weekday between 8 a.m. and 5 p.m. in any U.S. time zone. We serve all 50 U.S. states. Residents of Puerto Rico should contact their nearest HP sales office.

### Have ready when you call:

- Your company's purchase order number so we may reference it on your order.
- Your VISA, MasterCard or American Express card and expiration date for credit card orders.
- Your HP account number and your code number (both found on the mailing label if you received your catalog by mail).

## Shipping

---

### Free surface delivery

Our prices include regular surface freight delivery by carrier of our choosing. This includes inside delivery and special handling.

## Payment

---

### To open an account

It's easy. Just give us your company billing and shipping addresses and a purchase order number. We'll give you an account number in minutes.

### Credit cards

We accept VISA, MasterCard and American Express.

### Terms

Net 30 days from invoice date for HP account customers. Open account terms are subject to credit approval.

### Delivery charges

Our prices include regular surface delivery. Charges for any special types of delivery will appear separately on your invoice.

## Pricing

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### Effective date

Prices are net, effective November 1, 1995, and are valid in virtually all cases.

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# Product number listing of catalog items

<b>1</b>	Page
1660-series Logic analyzers.....	15
1664A 34-channel Logic analyzer .....	14
10070A Oscilloscope probe.....	10
10071A Oscilloscope probe.....	10
10072A SMT Kit .....	10
10073A Oscilloscope probe.....	10
10098A Accessory pouch/cover.....	7
10100C 50 $\Omega$ Load.....	10
10110B Dual banana adapter .....	10
10437A Oscilloscope probe.....	10
10438A Oscilloscope probe.....	10
10442A Oscilloscope probe.....	10
10444A Oscilloscope probe.....	10
10450A SMT Kit .....	10
10833A HP-IB Cable .....	33
10833B HP-IB Cable .....	33
10833C HP-IB Cable .....	33
10833D HP-IB Cable.....	33
10834A HP-IB to HP-IB Adapter.....	33
11000-60001 Dual banana plugs.....	33
11001-60001 BNC connector/banana plug.....	33
11053A Lug-to-lug jumpers.....	21
11058A Banana-to-banana jumpers.....	21
11059A Kelvin probe set.....	21
11060A Surface mount device probe.....	21
11062A Kelvin clip set.....	21
11094B 75 $\Omega$ Load.....	10
11174A Lug-to-banana jumpers .....	21
1137A High-voltage probe .....	10
1180B HP 1600-series Testmobile.....	15
1183A Testmobile scope cart.....	10
1251-2277 Dual banana adapter.....	10
 <b>3</b>	
3458A Multimeter .....	37
33120A Function Arb generator .....	22
34130A Test lead set .....	20
34161A Accessory pouch.....	21
34300A High-voltage probe .....	20
34301A RF Detector probe.....	20
34302A Current probe.....	20
34330A Current shunt.....	21
34398A RS-232 Cable .....	33
34399A RS-232 Adapter kit.....	33
34401A Multimeter .....	16
34810A BenchLink Scope software .....	30
34811A BenchLink Arb software.....	30
34812A BenchLink Meter software.....	31
34820A BenchLink Suite.....	31
35183A Work surface for HP 1180B.....	15

<b>4</b>	Page
40653B Surface sensor assembly with thermistor.....	21
 <b>5</b>	
5041-9409 HP 54600-series Carrying case .....	7
5062-7345 HP 54600-series Rack mount kit .....	7
5081-7705 BNC Adapter.....	10
53131A 225 MHz Universal counter .....	24
53132A 225 MHz Universal counter .....	24
53181A 225 MHz RF Counter .....	24
54520/40-series 500 MHz Oscilloscopes .....	36
54600-series Oscilloscopes.....	4
54600B 100 MHz Oscilloscope.....	6
54601B 100 MHz Oscilloscope.....	6
54602B 150 MHz Oscilloscope.....	6
54603B 60 MHz Oscilloscope.....	6
54610B 500 MHz Oscilloscope.....	6
54620A Logic analyzer .....	12
54650A HP-IB Interface module .....	8
54652A Parallel interface module .....	8
54652B RS-232 & Parallel interface module .....	8
54655A HP-IB Test automation module .....	8
54656A RS-232 Test automation module.....	8
54657A HP-IB Measurement/storage module.....	8
54659B RS-232 & Parallel measurement/storage module.....	8
54654A HP 54600-series Operator's training kit...7	
 <b>8</b>	
8110A 150 MHz pulse generator.....	37
8120-1838 BNC Connectors .....	33
8120-1839 BNC Connectors .....	33
8120-1840 BNC Connectors .....	33
82335B HP-IB Card for Windows and DOS.....	32
82340A HP-IB Card and SICL for Windows 3.1 ..32	
82341C High-performance HP-IB card for Windows .....	32
8590L Portable spectrum analyzer.....	34
8648A Economy RF signal generator .....	35
8648B Economy RF signal generator .....	35
8648C Economy RF signal generator .....	35
8711B Family of RF economy network analyzers.....	35

<b>9</b>	Page
971A Handheld multimeter.....	18
972A Handheld multimeter.....	18
973A Handheld multimeter.....	18
974A Handheld multimeter.....	18

<b>C</b>	
C2913A RS-232 Cable .....	33
C2914A RS-232 Cable .....	33

<b>E</b>	
E2301A Surface type-K thermocouple probe .....	20
E2303A SMP-to-dual banana plug adapter .....	20
E2304A Handheld multimeter carrying case.....	20
E2305A Spare test leads.....	20
E2306A Test lead kit.....	20
E2307A Type-K thermocouple bead temperature probe .....	21
E2308A Thermistor temperature probe.....	21
E2373A Handheld multimeter .....	19
E2427A HP 1660-series HIL Keyboard kit .....	15
E3610A Power supply.....	28
E3611A Power supply.....	28
E3612A Power supply.....	28
E3614A Power supply.....	28
E3615A Power supply.....	28
E3616A Power supply.....	28
E3617A Power supply.....	28
E3620A Power supply.....	27
E3630A Power supply.....	27
E3631A Power supply.....	26



# Alphabetical listing of catalog items

<b>A</b>	Page
Accessories	
Cables	33
Function/arbitrary waveform generators	22, 23
Logic analyzers	11-15
Multimeter, digital	16, 17, 37
Multimeters, digital handheld	18, 19
Oscilloscopes	4-10
Universal counters	24, 25
Analyzers, logic	11-15

<b>B</b>	
BenchLink Arb software	30
BenchLink Meter software	31
BenchLink Scope software	30
BenchLink Suite software	31

<b>C</b>	
Cables	
Coaxial	33
HP-IB	33
RS-232	33
Catalogs	34, 36, 38
Counters, universal	24, 25
Accessory pouch	21
BenchLink Meter software	31

<b>D</b>	
Digital oscilloscopes	4-7, 36
BenchLink Scope software	30
Digital multimeter	16, 17, 37
Digital handheld multimeters	18, 19

<b>F</b>	
Function/Arb generator	22, 23
Accessories	23
Accessory pouch	21
BenchLink Arb software	30
Function generator	22

<b>H</b>	
HP DIRECT Resource Line	3
HP-IB Cards	32
Cables	33
HP Power Products Catalog	36

<b>I</b>	Page
Internet home page	38

<b>K</b>	
Kelvin	
Probe set	21
Clip set	21

<b>L</b>	
Logic analyzers	11-15
Accessories	13, 15
Rack mount kit	13, 15

<b>M</b>	
Microwave Test Accessories	
Catalog	34
Modules for 54600-series oscilloscopes	
FFT	8
Interface	9
Measurement/Storage	8
Test Automation	8
Multimeters, digital	16, 17, 37
Accessory pouch	21
BenchLink Meter software	31
Jumpers	21
Kelvin clip set	21
Probes	20, 21
Shunt	21
Test leads	20
Multimeters, handheld	18, 19
Accessories	20, 21
Carrying case	20
Surface probe	20, 21
Temperature probes	21
Test leads	20
Thermistor probe	21
Thermocouple adapter	20

<b>N</b>	
Network analyzers	35

<b>O</b>	
Ordering information	39
Oscilloscopes, digitizing	4-7, 36
Accessories	7, 10
BenchLink Scope software	30
Modules	8, 9
Operator's training kit	7
Probes	7, 10
Rack mount kit	7
TV/Video trigger	7

<b>P</b>	Page
Power Products Catalog	36
Power supplies, bench	26-29

<b>R</b>	
Rack mount kits	
Logic analyzer	13, 15
Oscilloscopes	7
Rack Solutions Catalog	38
RF network analyzers	35
RF signal generators	35
RS-232 Cables	33

<b>S</b>	
Signal generators	35
Software	
BenchLink Arb	30
BenchLink Meter	31
BenchLink Scope	30
BenchLink Suite	31
HP-IB card	32
Specs and performance	
data sheets	38
Spectrum analyzer	34
Synthesized signal generator	22

<b>T</b>	
Test & Measurement Catalog	38
Testmobile	
Oscilloscope	10
Logic analyzer	15

<b>U</b>	
Universal counters	24, 25
Accessory pouch	21

<b>V</b>	
Voltmeters (see Multimeter, digital)	

<b>W</b>	
Warranty information	39



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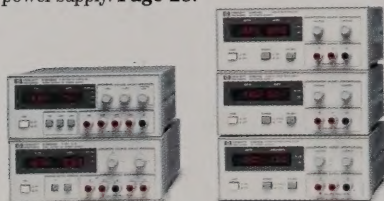
**HP 34401A**  
Digital multimeter.  
6½ digit multimeter at the price  
of 5½ digits. **Page 16.**



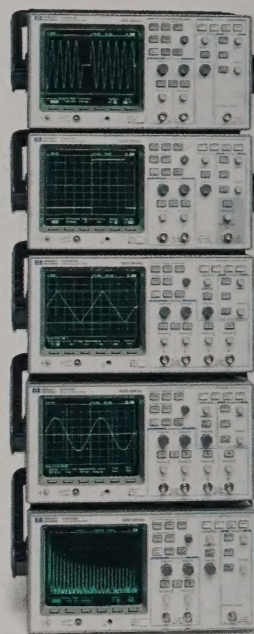
**HP 970-series and HP E2373A DMMs.**  
Benchtop features in a handheld. **Page 18.**



**HP E3600-series power supplies.**  
Ten options for clean output from a benchtop  
power supply. **Page 28.**



What kind of waveform do you need?  
See **page 22** for the **HP 33120A.**



**HP 54600-series oscilloscopes.**  
Analog feel and digital power.  
**Page 4.**

**HP E3631A triple-output DC power supply.**  
Precise, programmable power and versatility —  
within your budget. **Page 26.**



**NEW!**



**HP 53131/32/81A 225 MHz**  
counters that offer 10 to 12  
digit/sec resolution. **Page 24.**



**HP 54620A logic analyzer. Page 12.**  
**HP 1664A logic analyzer. Page 14.**

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